



Performance Validation of the ANSER Control Laws for the F-18 HARV

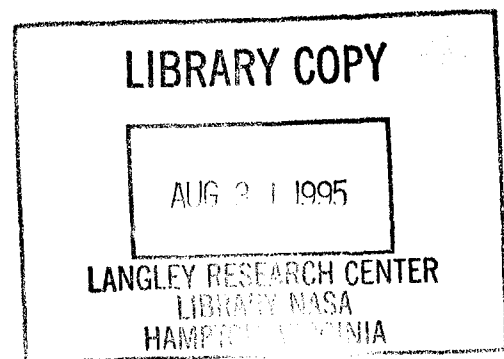
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PERFORMANCE VALIDATION OF THE ANSER CONTROL LAWS FOR THE F-18 HARV*

Final Report

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*Appendixes A, C, and D published under separate cover as NASA CR-198196, Part 1.

Overview

The Actuated Nose Strakes for Enhanced Rolling (ANSER) Control Laws were developed by NASA Langley and Dryden to be used during Phase III HARV flight testing of the actuated nose strakes. These control laws are a product of the same design methodologies as those used for the NASA-1A control laws. The ANSER control laws will exercise logic for mode switching and nose-strake control that was included in the NASA-1A control laws, but disabled for the NASA-1A flight tests during Phase II. For Phase III of the HARV research flights, nose strakes have been added to the forebody of the aircraft and will be exercised during flight. Furthermore, based on NASA-1A flight test results, some modifications were made to the CDR version of the ANSER Control Laws to improve performance.

The ANSER Control Laws (Ref. 1) were implemented in Ada by NASA Dryden for flight test on the High Alpha Research Vehicle (HARV). The Ada implementation was tested in the Hardware-In-the-Loop (HIL) simulation, and results were compared to those obtained with the NASA Langley Fortran implementation of the control laws which are considered the "truth model". This performance validation process is the same as that used for the NASA-1A Control Laws (Ref. 2). These tests were specified by the *ANSER Performance Validation Test Plan* (Appendix A) and were intended to be a comprehensive performance evaluation of the Ada implementation.

The HIL vs. batch time-history comparisons for the ANSER performance validation checkcases are shown in Appendix B. The simulation scripts used to generate these checkcases are shown in Appendix C. A list of issues that arose during the ANSER performance validation tests, usually as a result of differences between the HIL and batch results, is shown in Appendix D. In all checkcases where significant discrepancies existed, analysis was performed to isolate and understand these discrepancies. Appendix D also contains the results of these analyses.

Discussion of Results

As noted in the previous section, some differences were noted between the and batch time-history results, and results of the

analyses of the significant differences can be found in Appendix D. A brief summary of the most important differences, particularly those which resulted in modifications to the control law, are discussed below. See Appendix D for more detail.

Lateral Stick Selection Logic

Effects of the HIL signal selection logic were noticed in the NASA-1A testing and reported in (Ref. 2). This effect was still present during the ANSER Performance Validation Tests and was particularly noticeable on the lateral stick signal. For these tests a first order lead-lag filter was developed and shown to successfully model the signal selected lateral stick. Use of this filter in the batch simulation greatly facilitated comparison of the HIL and batch time histories by removing a major cause of differences between the two.

Lateral Sensitivity

During examination of the results of checkcase 23 a lateral sensitivity characterized by an overshoot in the HIL left strake command was discovered in the angle-of-attack region between 30 and 40 degrees. The ensuing analysis included adding time delays to the batch simulation, running additional simulation cases, and investigating the strake aero model. The result was a modification to the control law consisting of gain changes at 35 and 40 degrees AOA.

Lateral Stick Command Rate Limit

During testing of the lateral sensitivity issue, an error in the lateral stick command rate limit in the Ada code was discovered and corrected.

Pitch Command Limit

During study of checkcase 28, which included a 5 inch longitudinal step input, it was noted that the total pitch stick command, labeled PSGTOT internally in the ANSER longitudinal control system, could exceed 5 inches, which is the aft position limit on the longitudinal stick. Analysis of the problem led to a modification of the control law consisting of the addition of a limiter on PSGTOT.

Other issues discussed in Appendix D include several differences between the HIL and batch simulations which were noted in NASA-1A testing. These include a number of issues relative to surface rate and position limits.

Summary and Conclusions

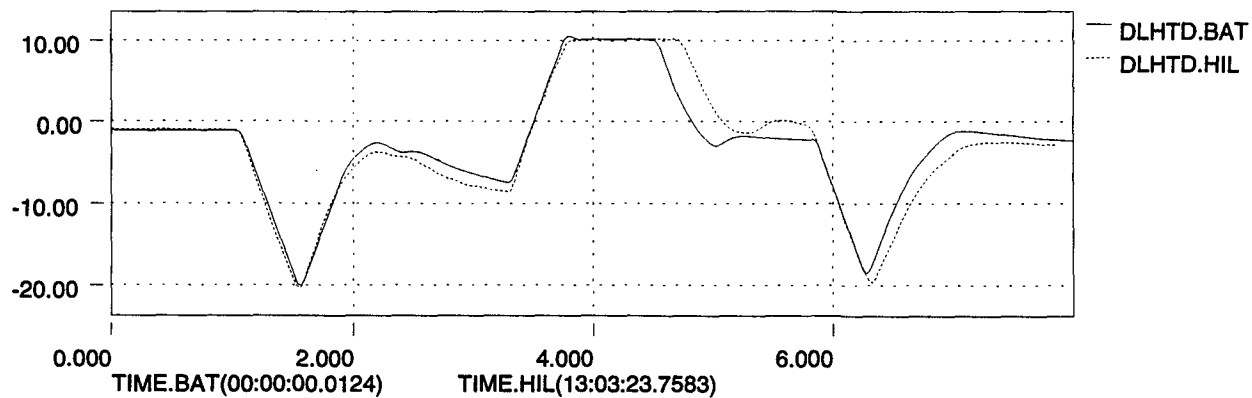
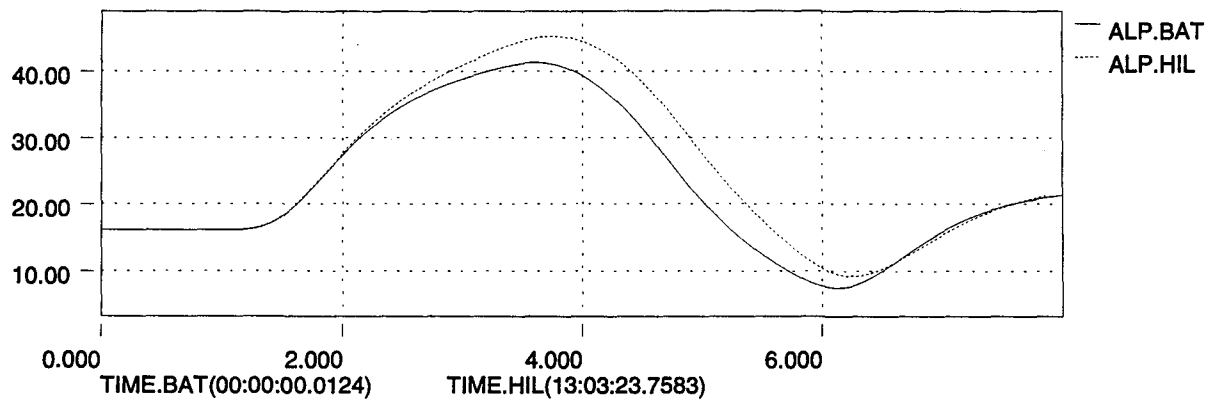
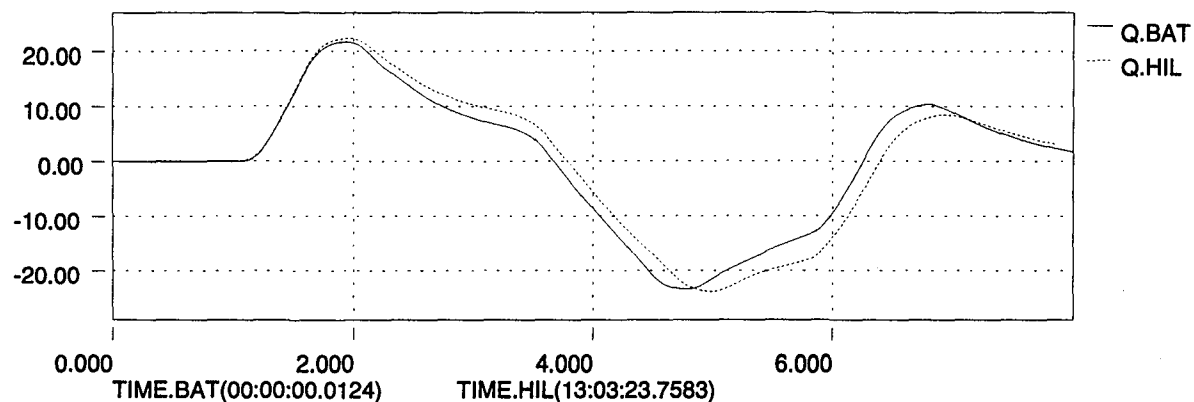
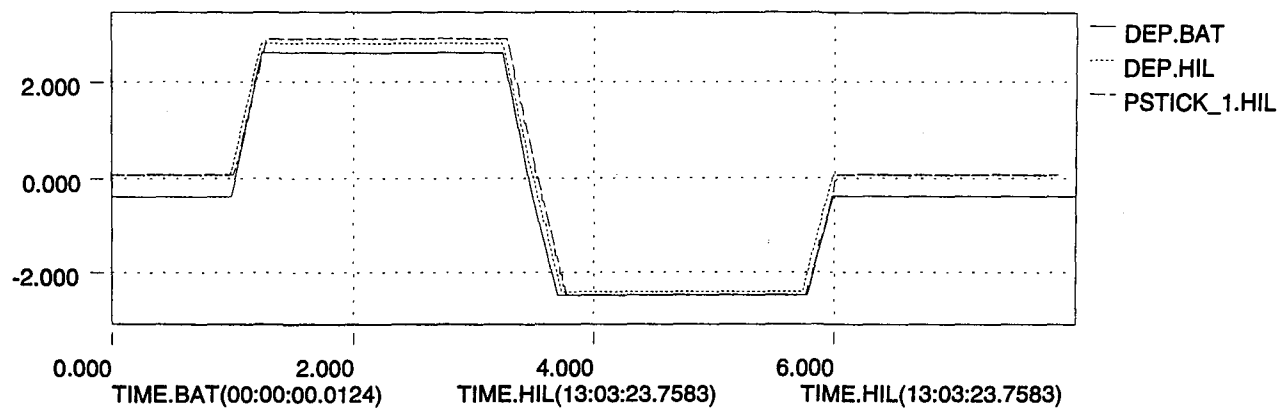
The Ada implementation of the ANSER control laws was tested in the HIL simulation and compared with the Fortran control law implementation in batch simulation. There are differences between the HIL and batch simulation results, but the significant differences are accounted for by known differences in the simulations. When these differences are taken into account, the time-history results between simulations compare relatively well. The Ada implementation of the ANSER Control Laws performs satisfactorily and is ready for Phase III flight test.

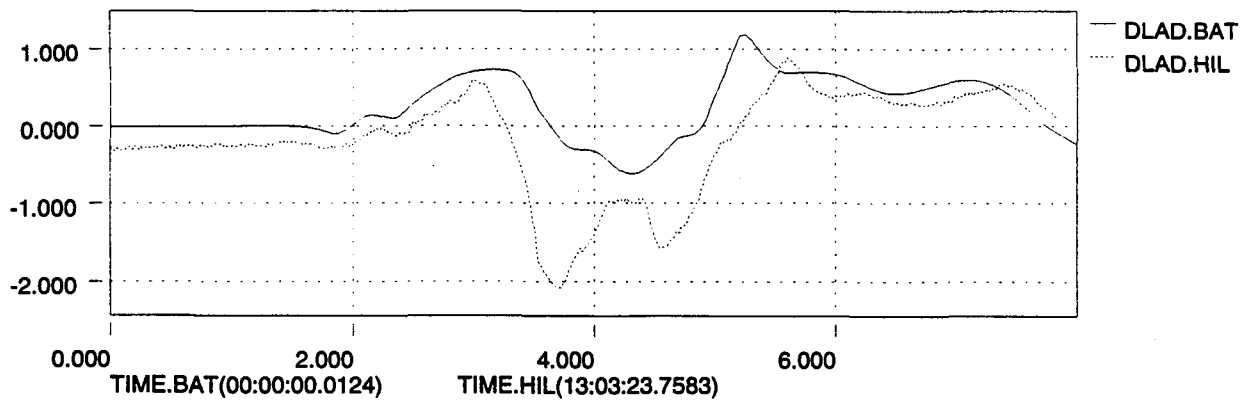
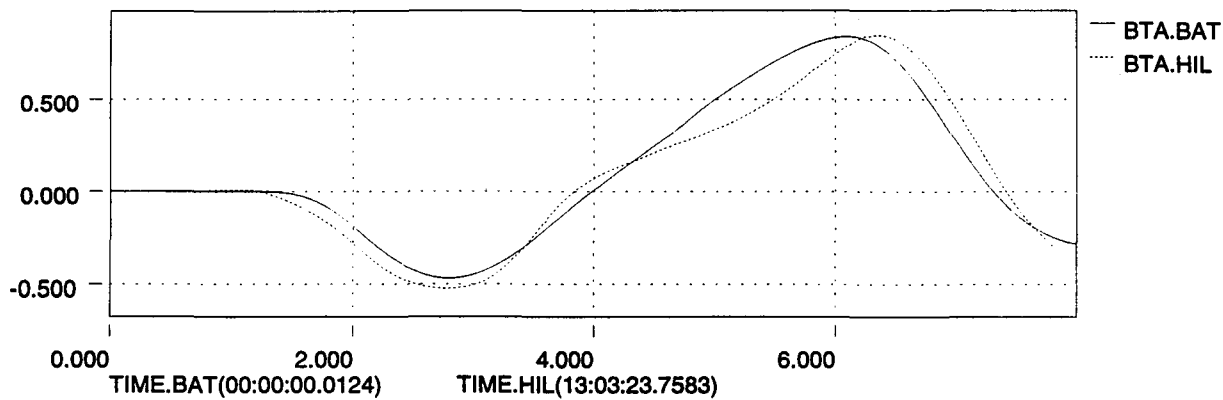
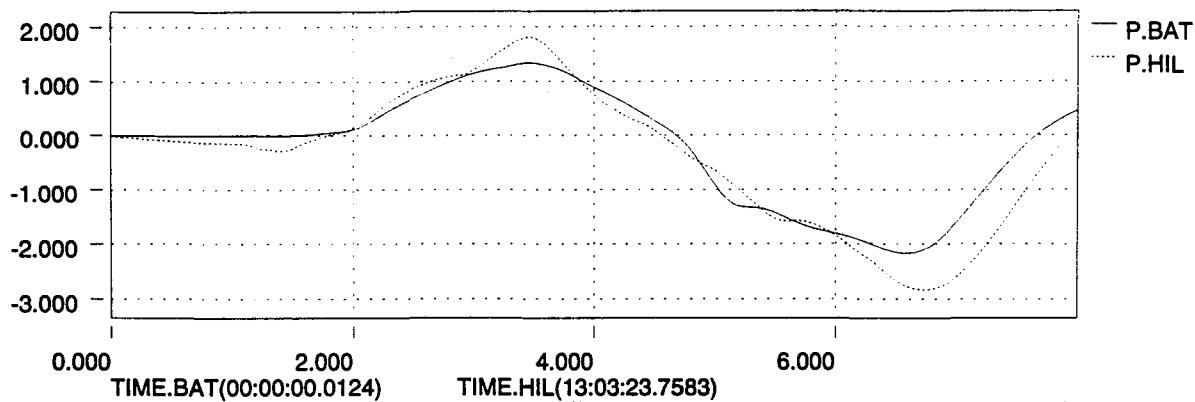
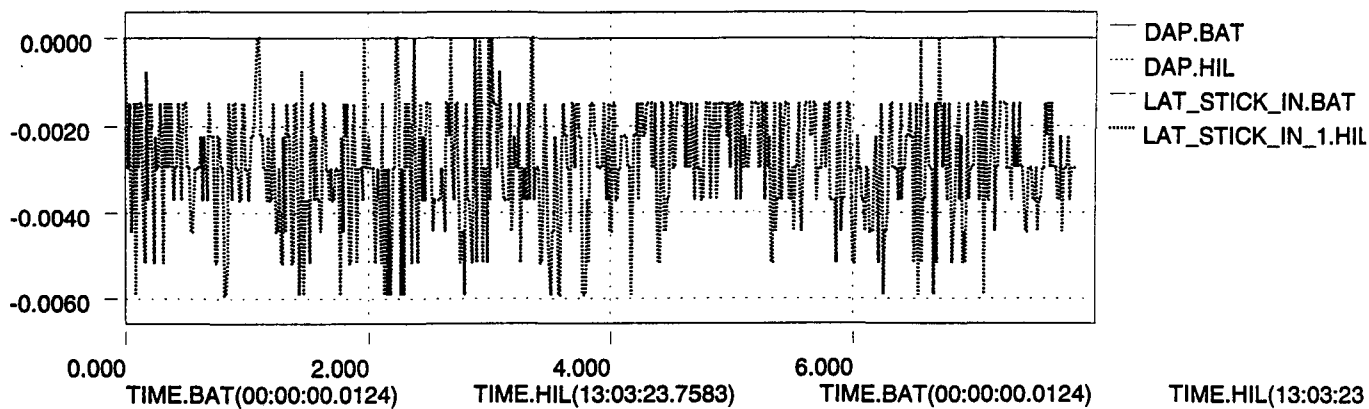
References

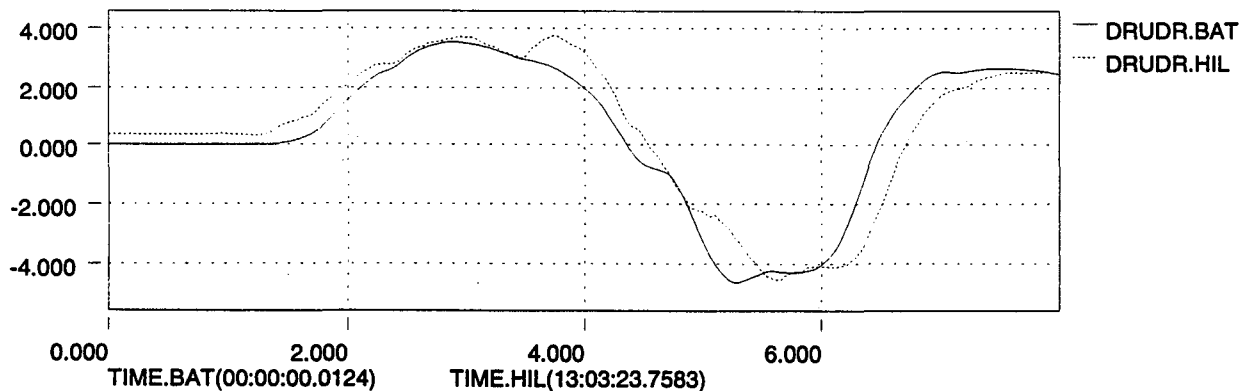
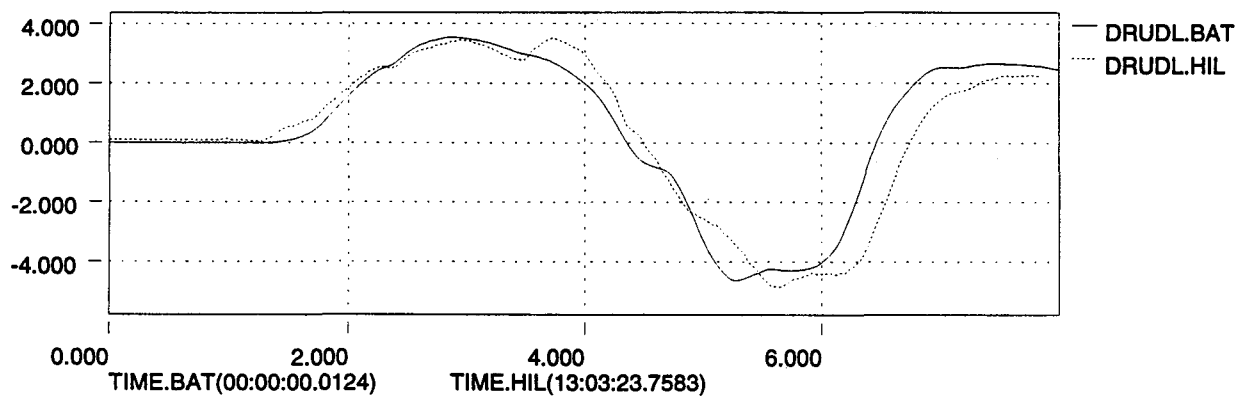
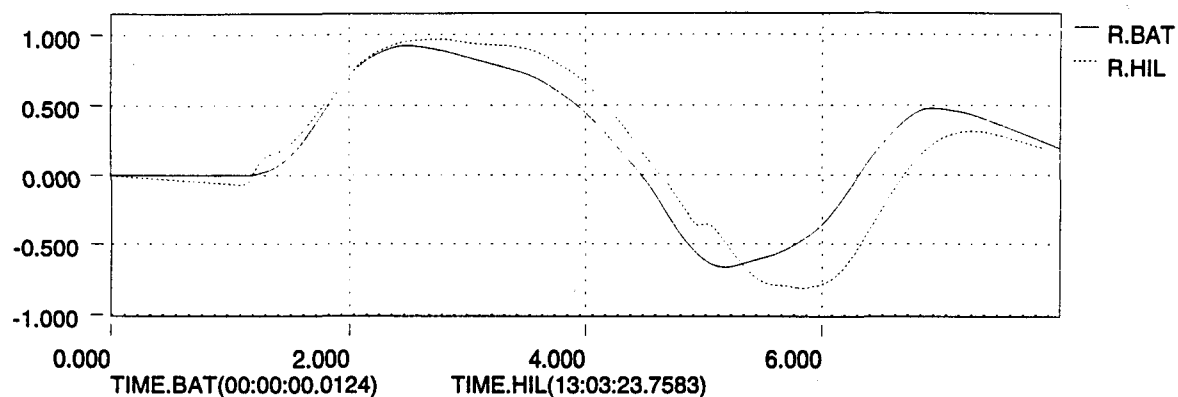
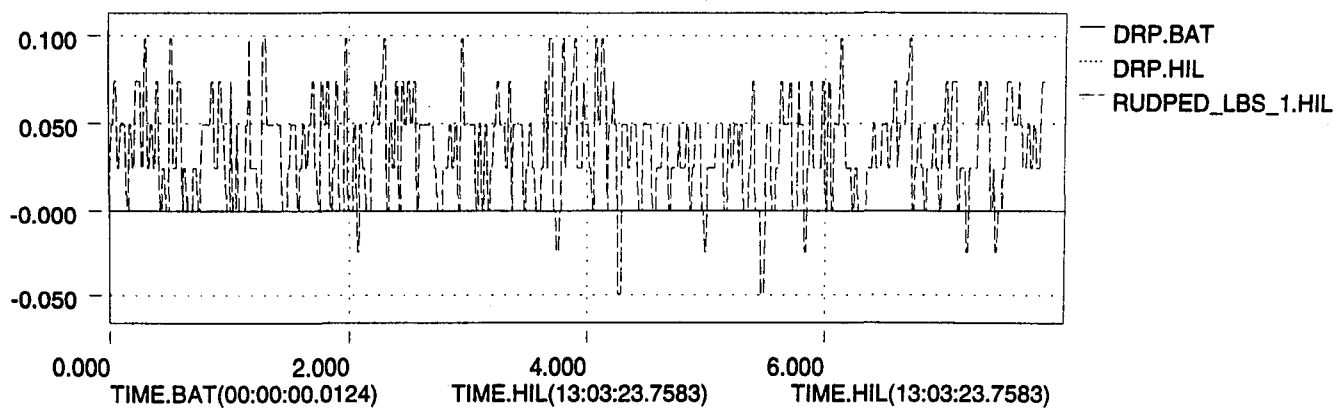
1. HARV ANSER Control Law Specification - Revision G, Longitudinal Controls - Version 150, Lateral/Directional Feedback Controls - Version 6.9.9 L, Lateral/Directional Pseudo Controls - Version 8.1, 28 November 1994. Langley Research Center Hampton, Virginia.
2. Performance Validation of the NASA-1A Control Laws for the F-18 HARV Final Report. HARV Document: HA-94-6-66, 21 March 1994.

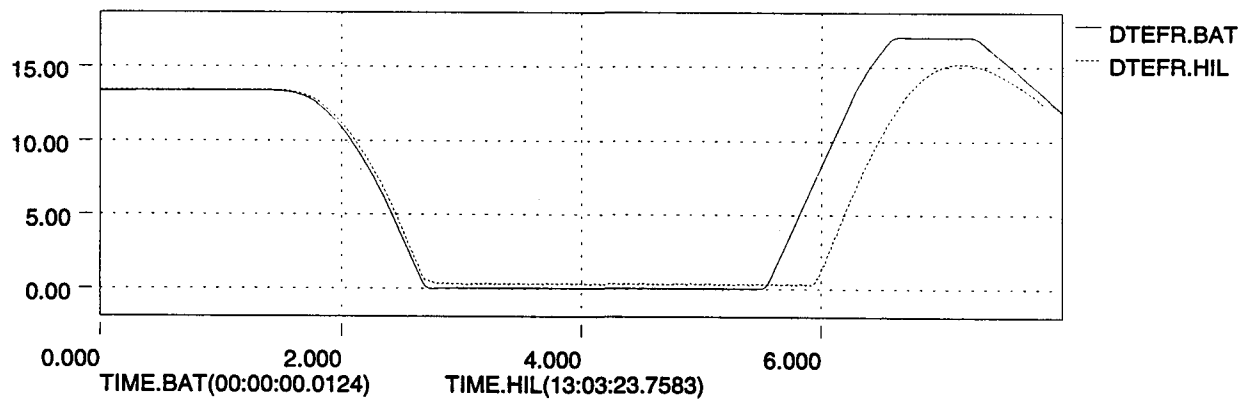
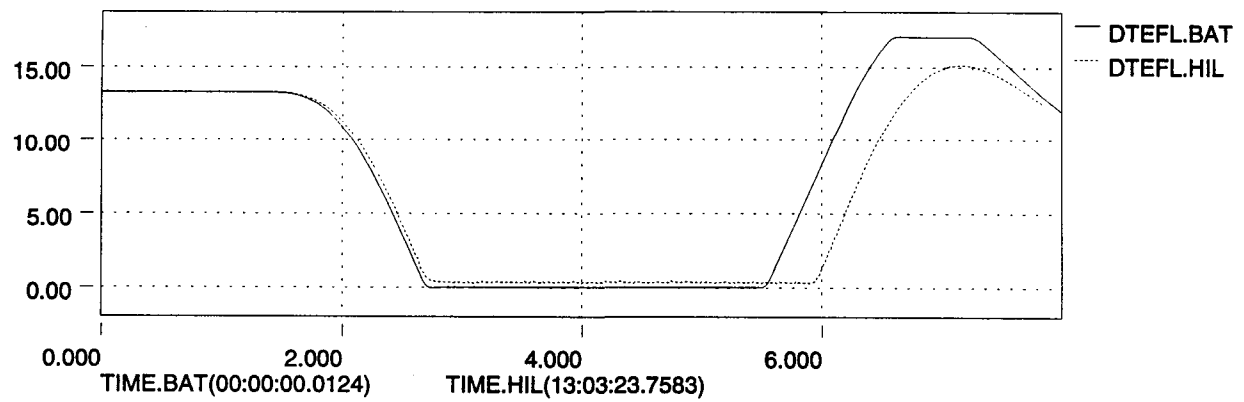
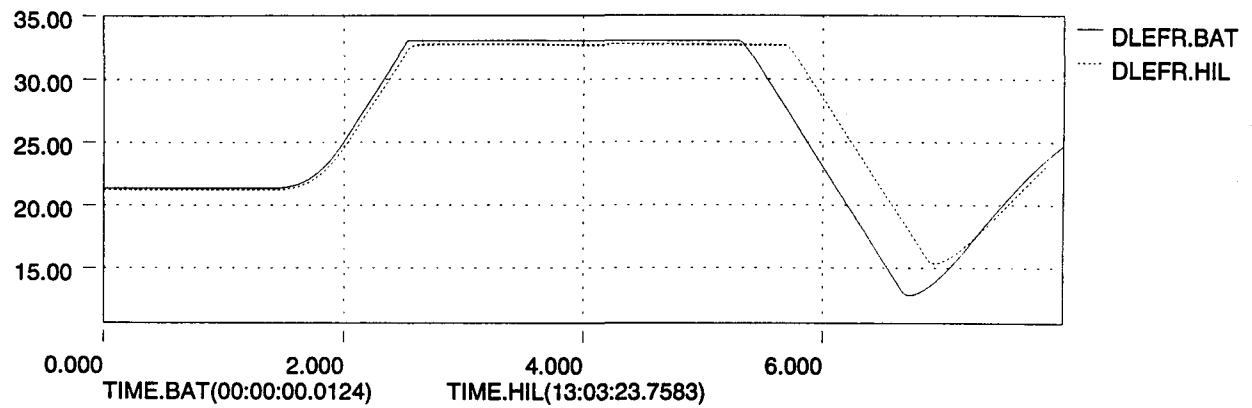
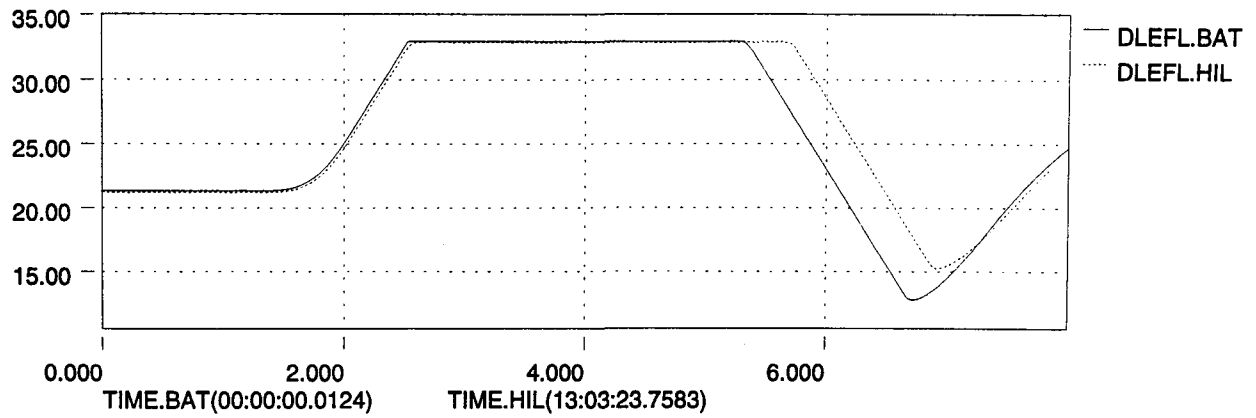
Appendix B

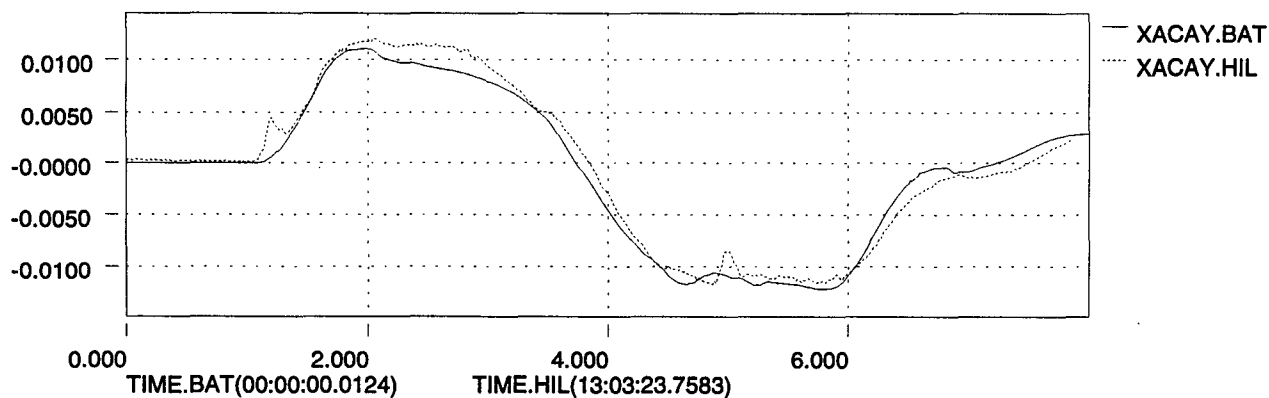
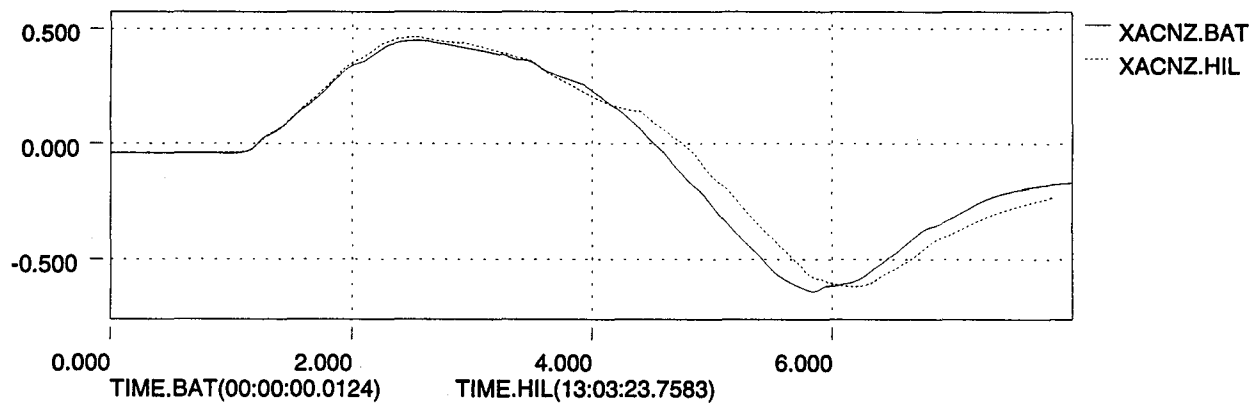
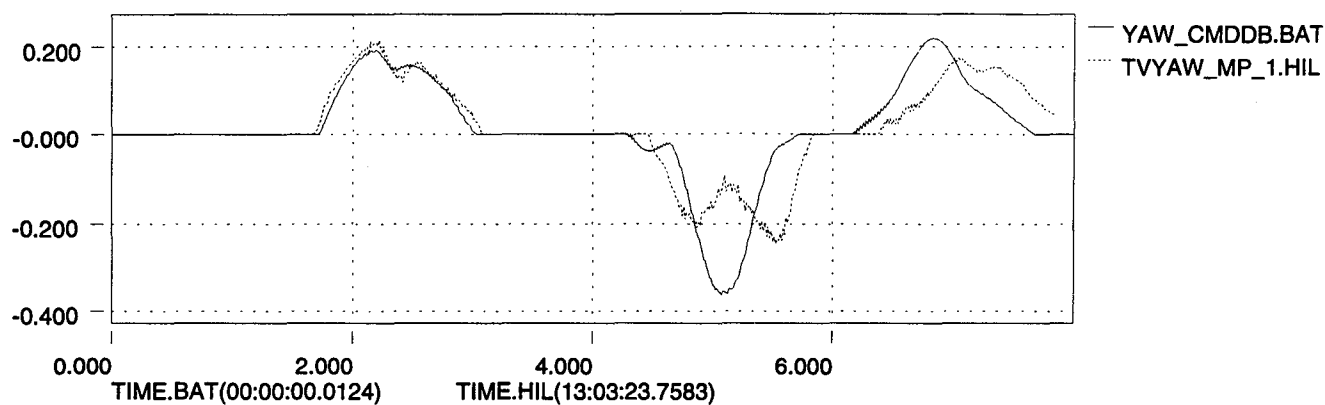
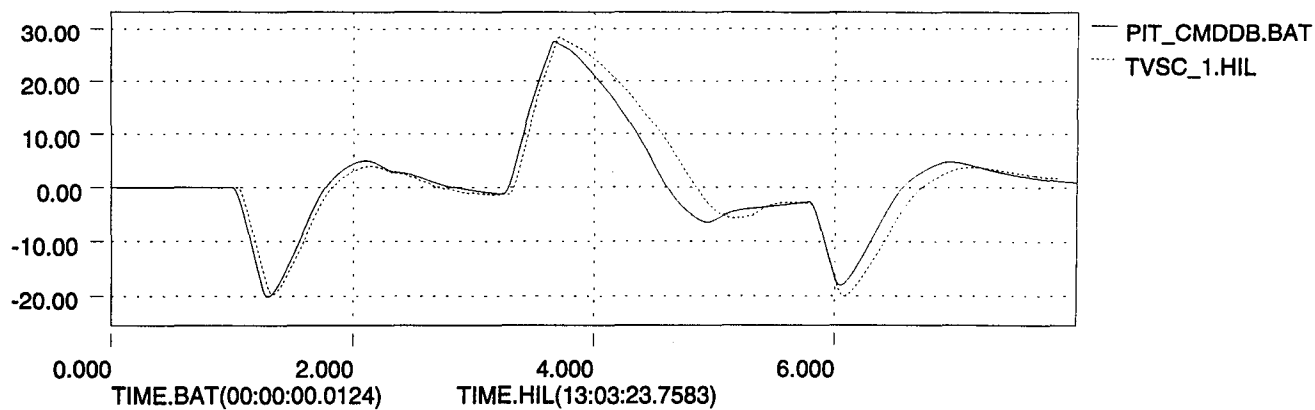
BATCH VS. HARDWARE-IN-THE-LOOP TIME HISTORIES



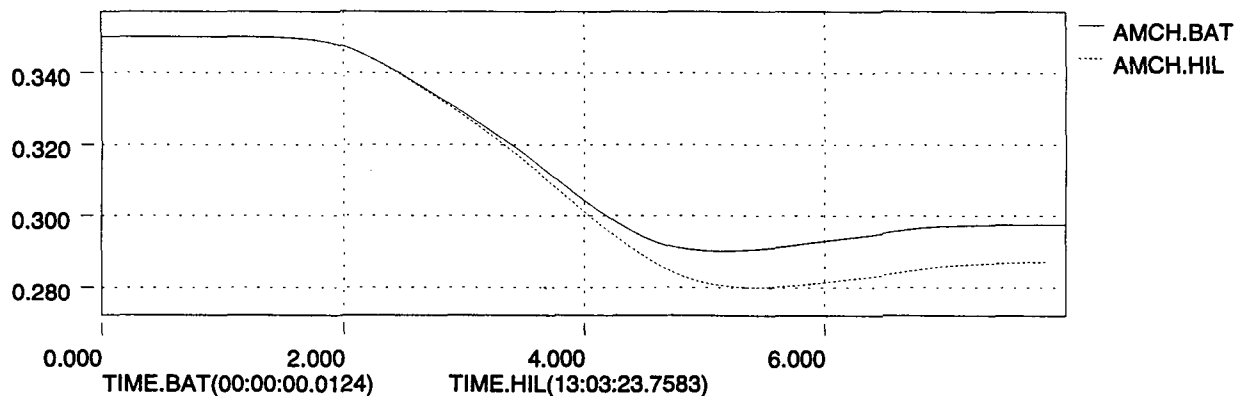
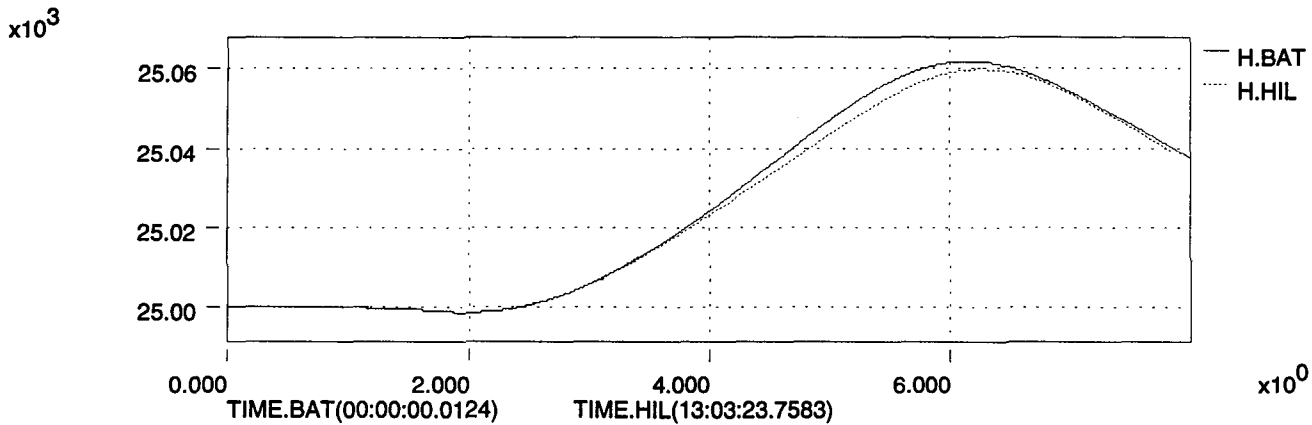
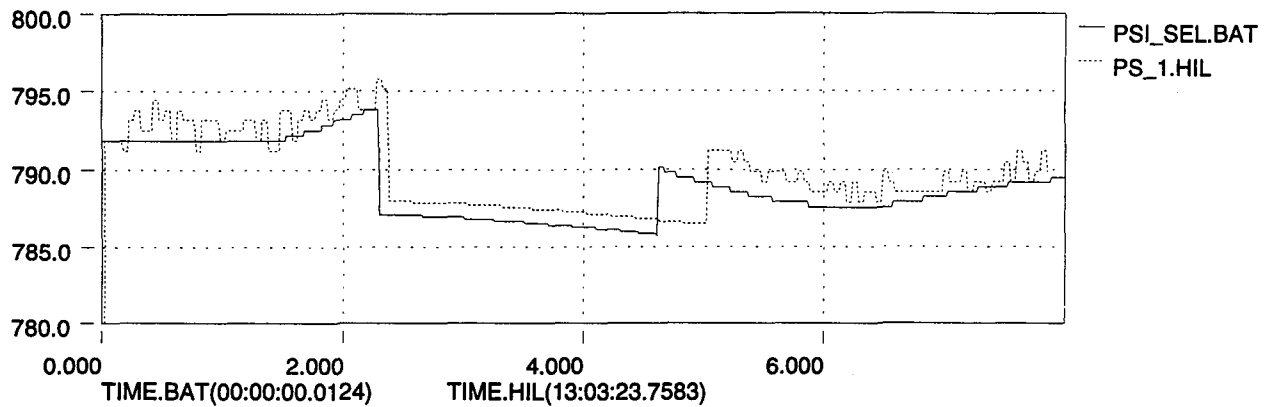
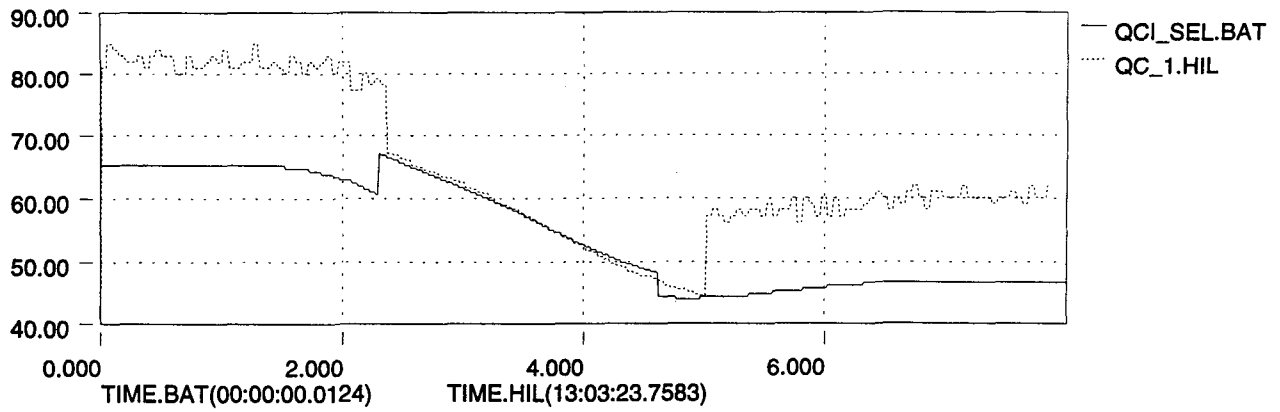


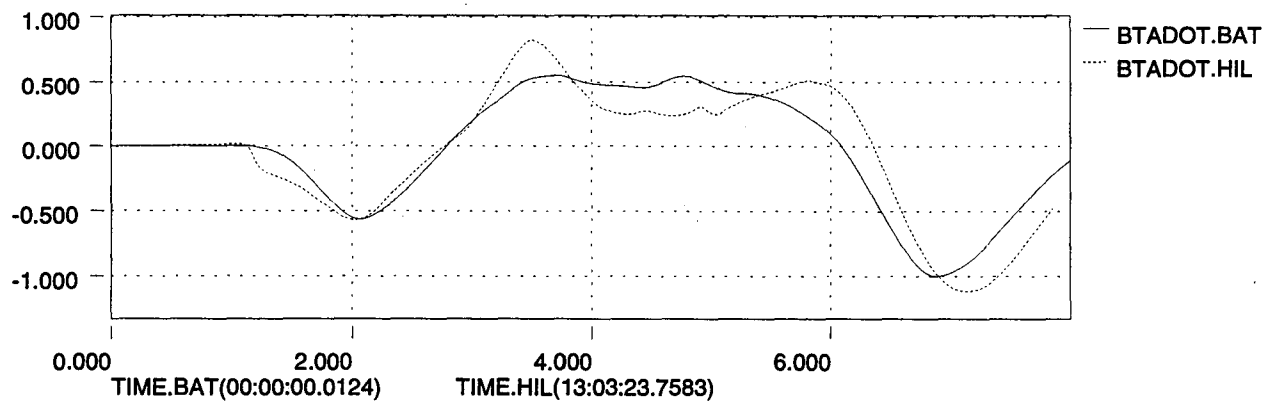
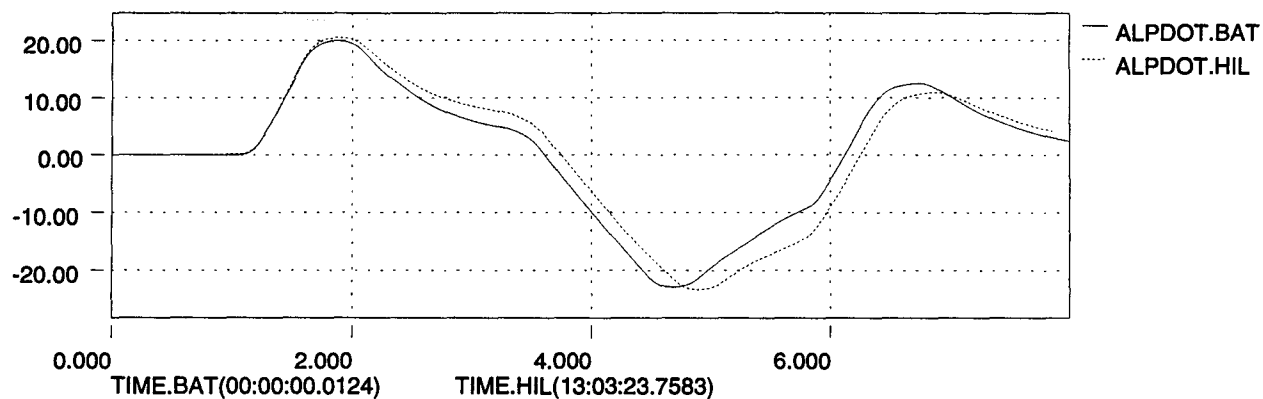
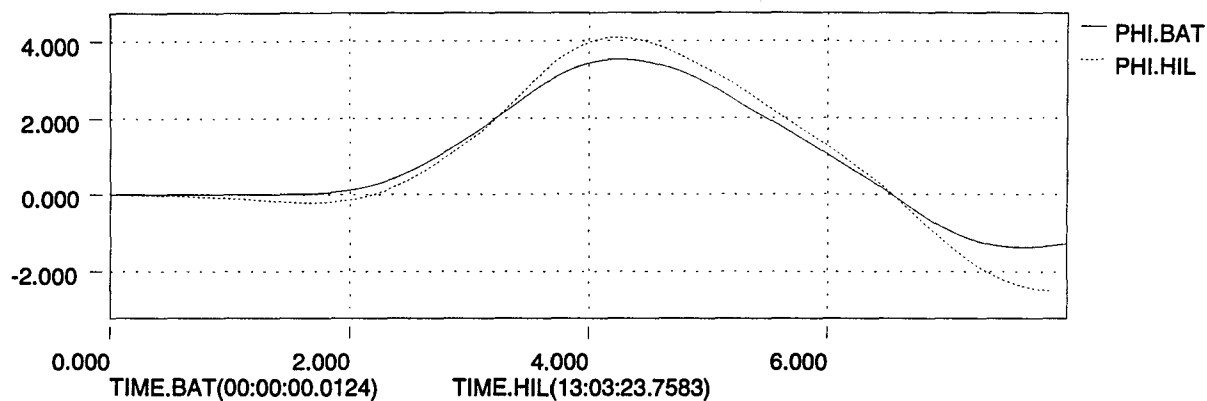
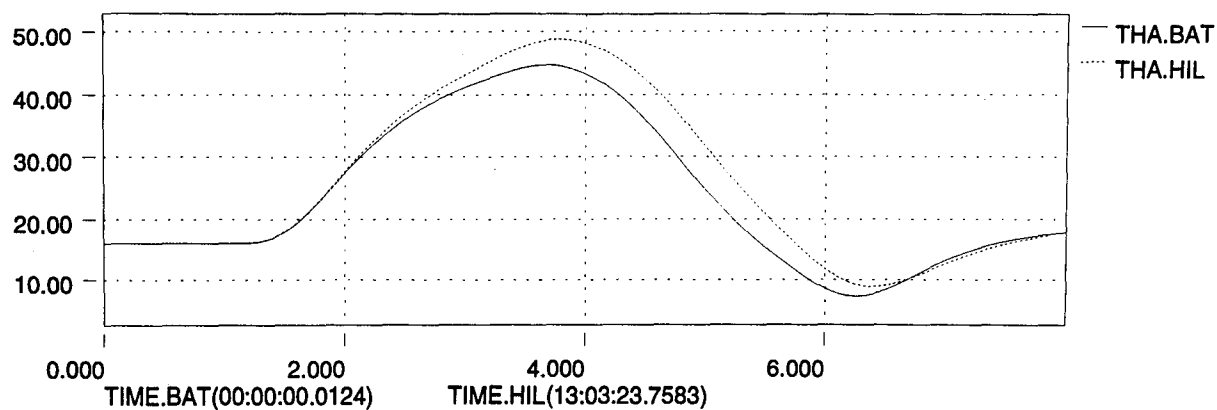


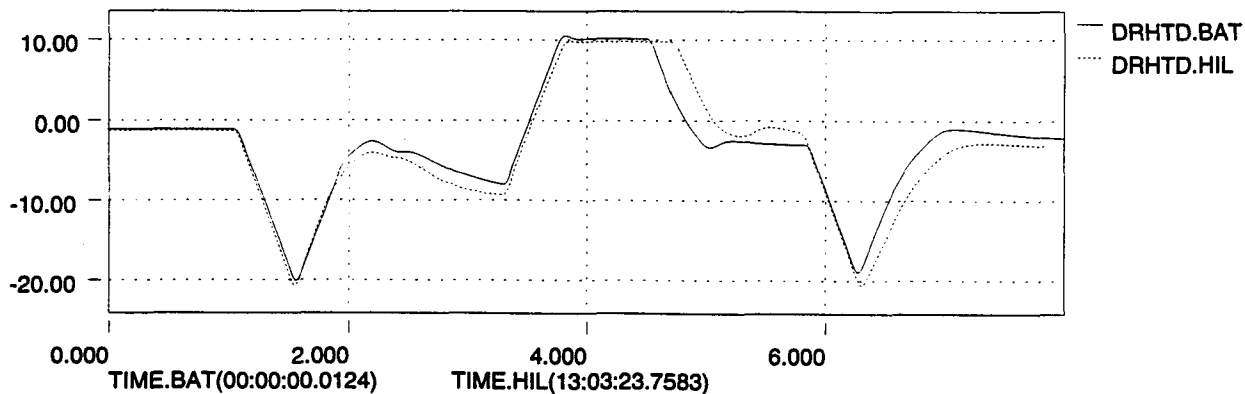
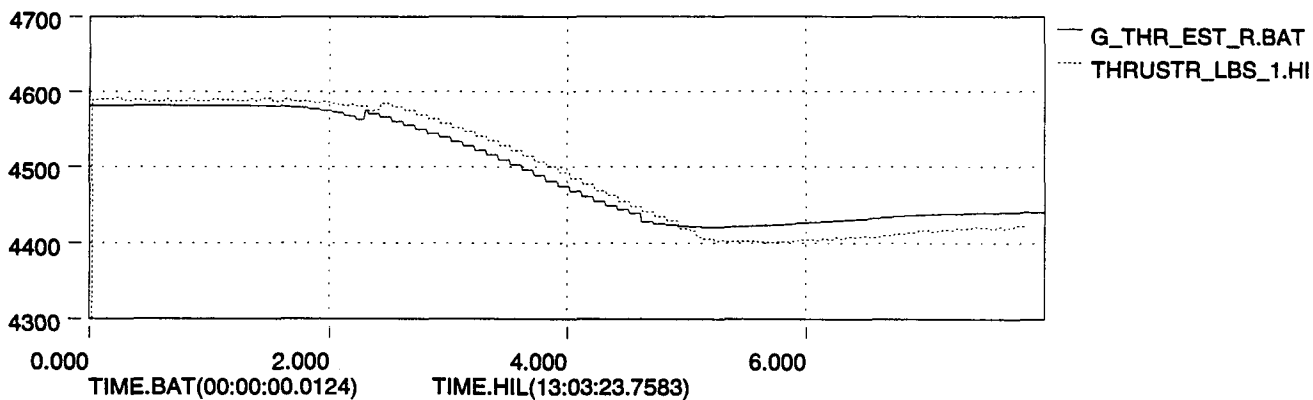
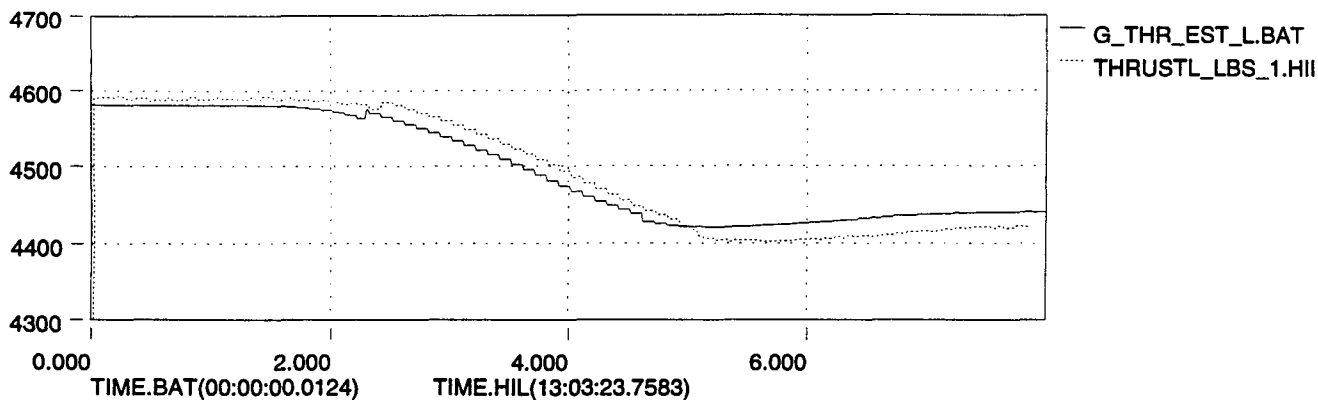
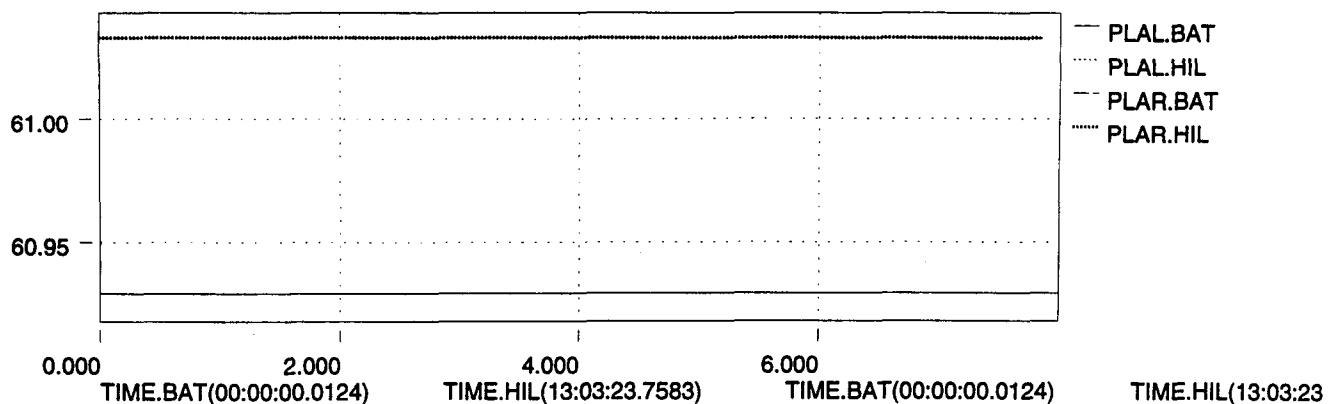


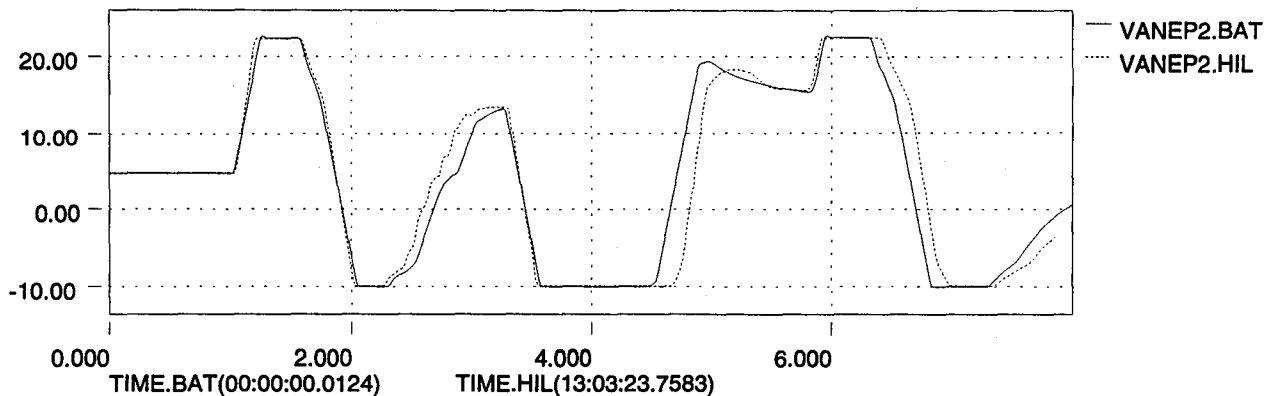
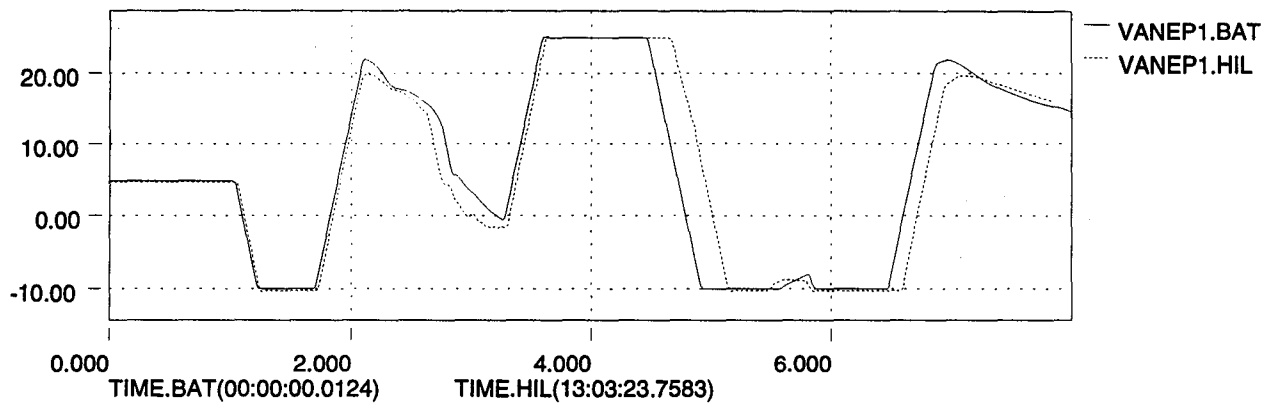
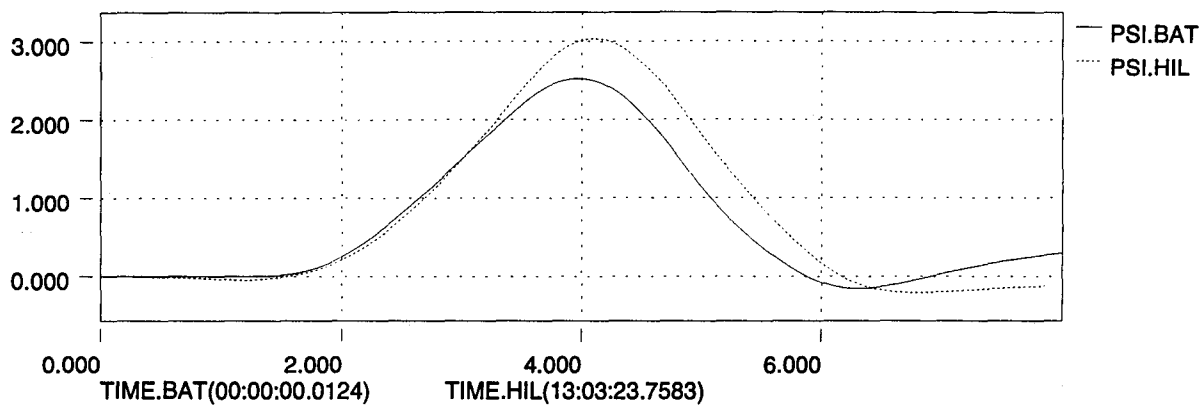
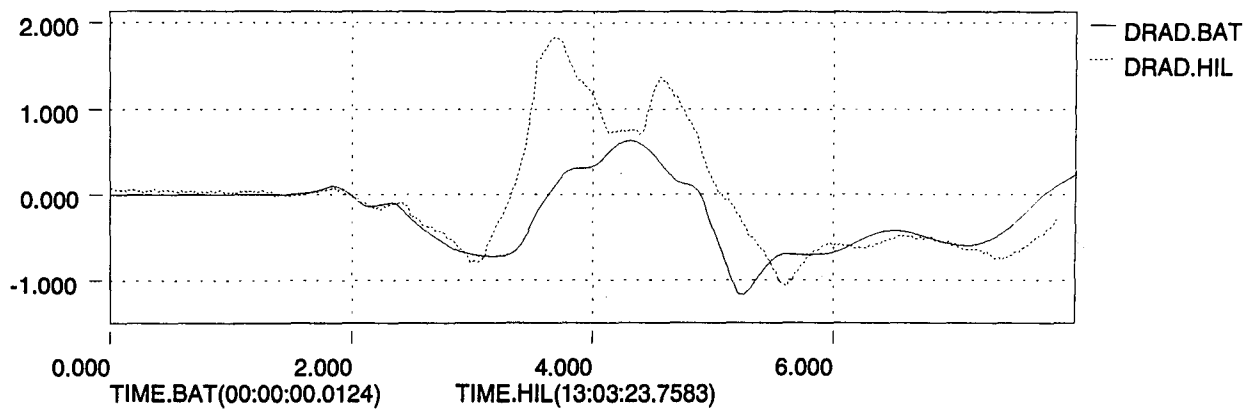


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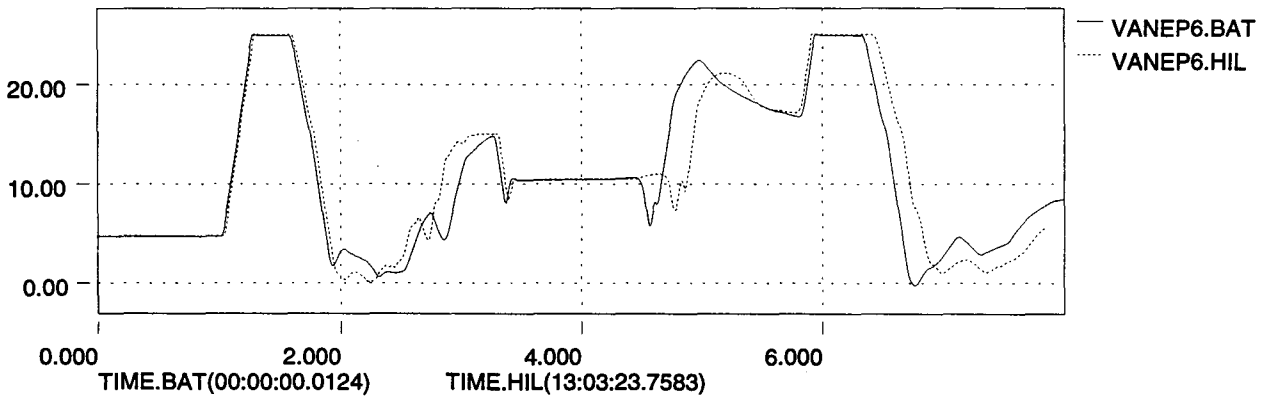
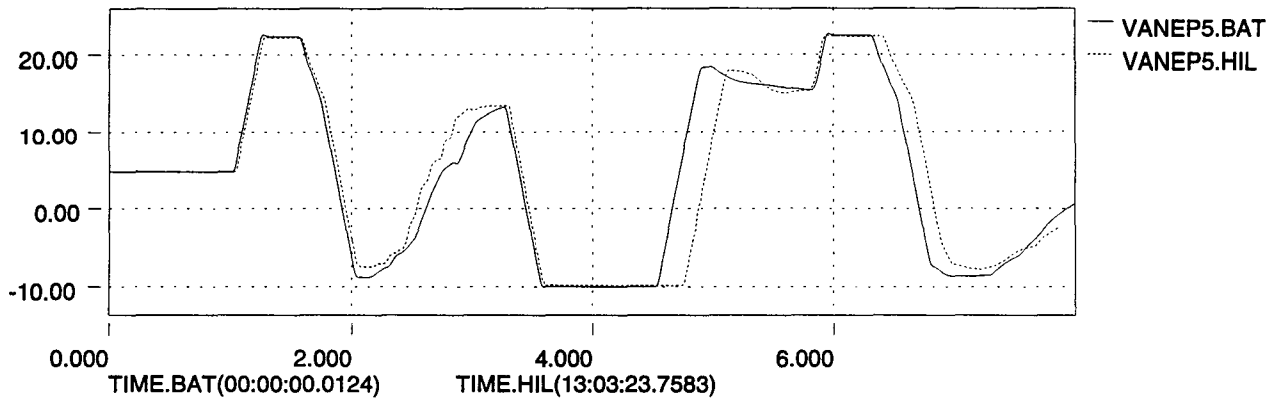
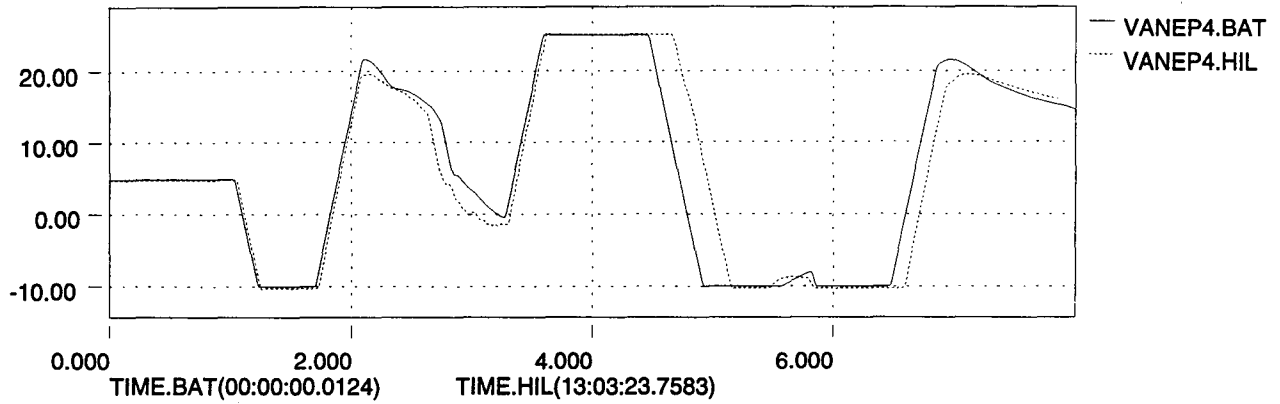
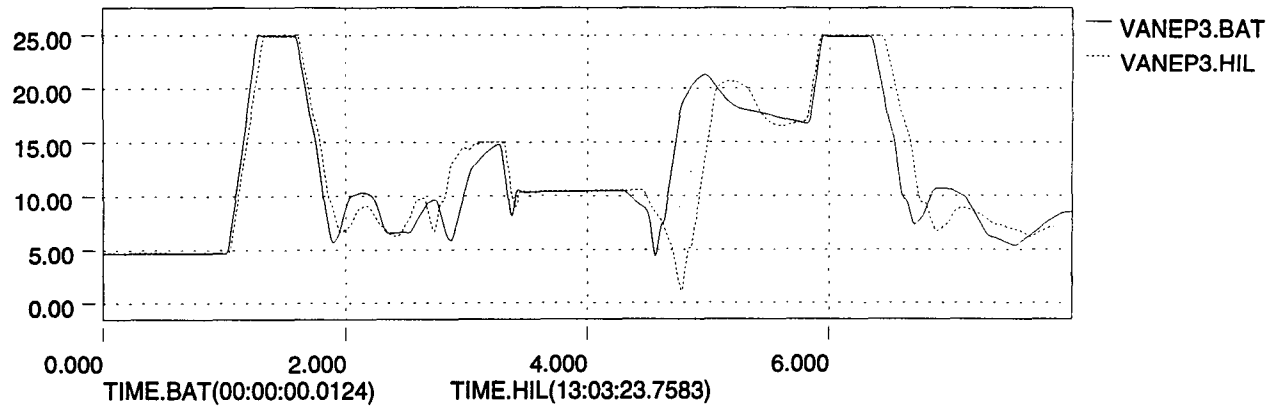




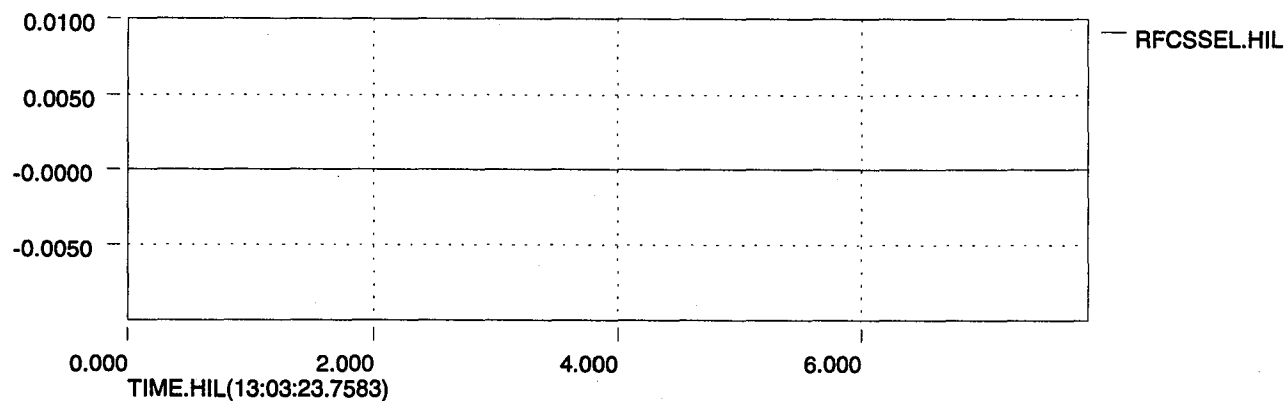
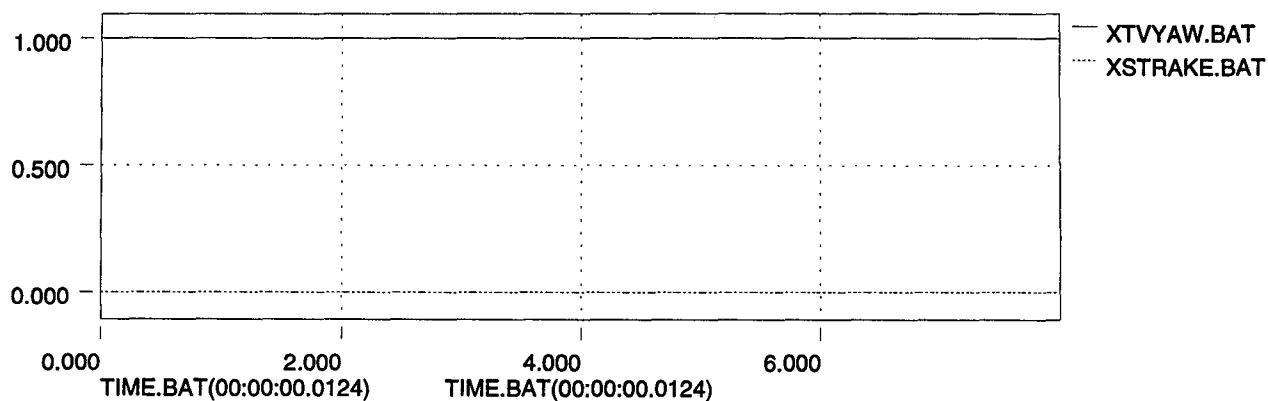
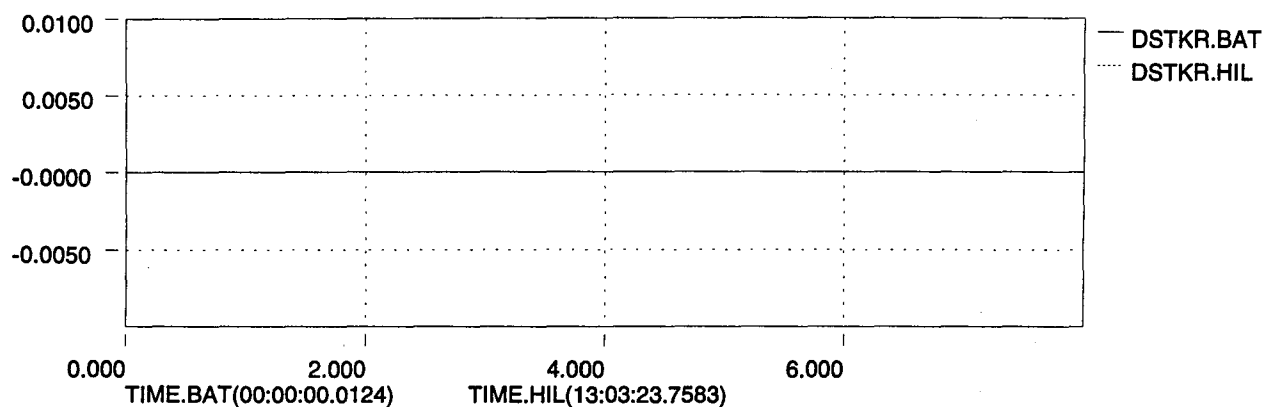
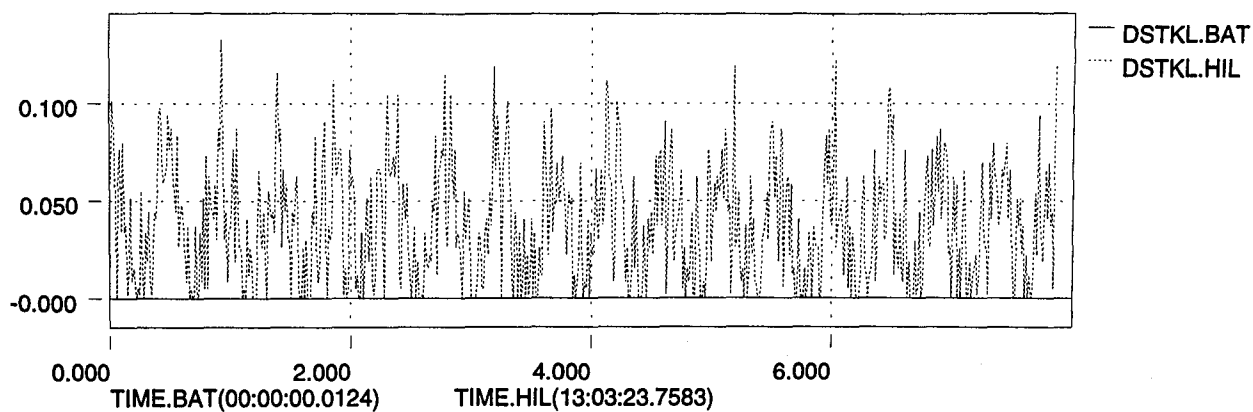




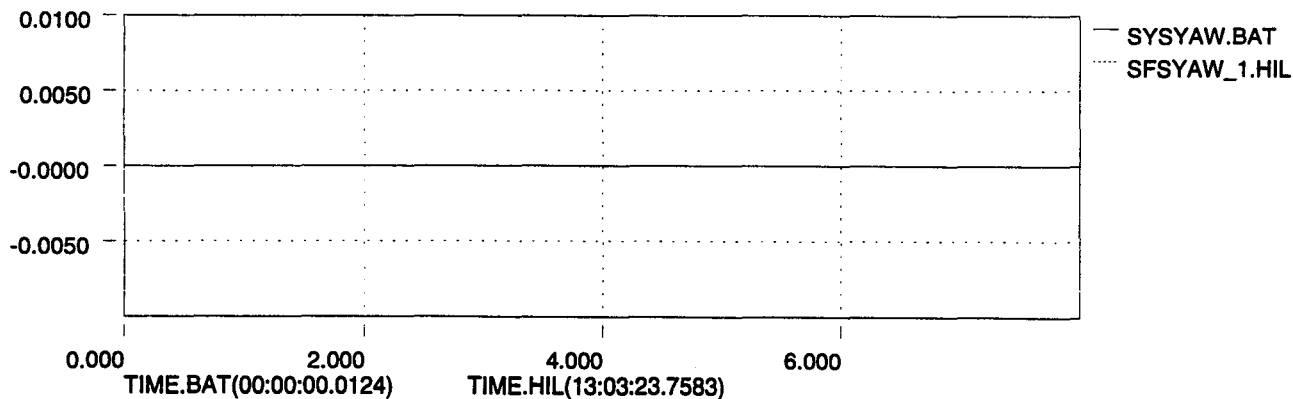
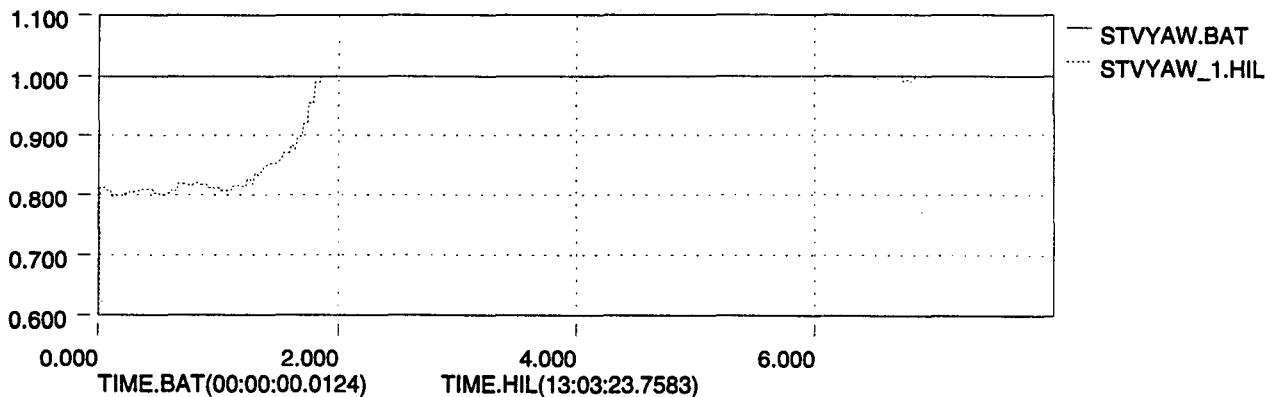
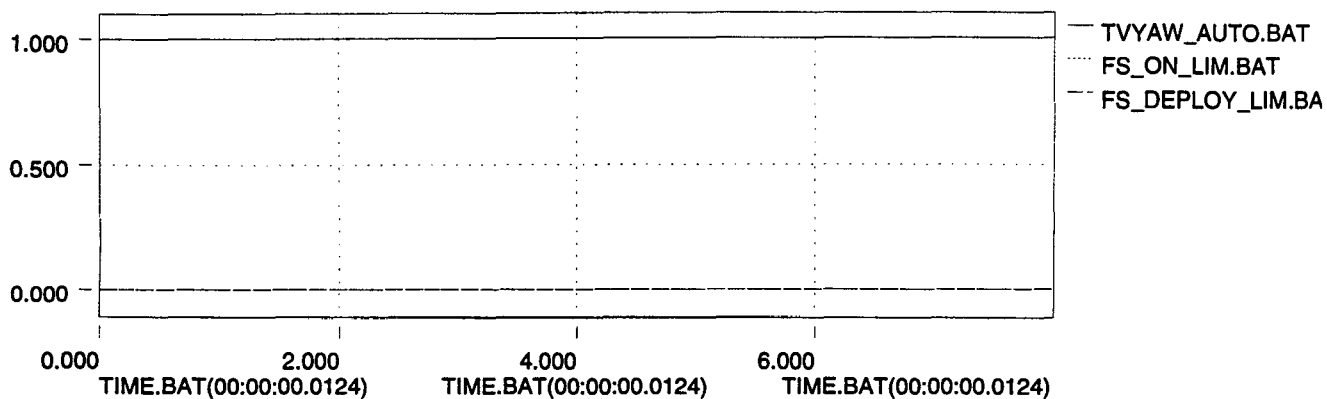
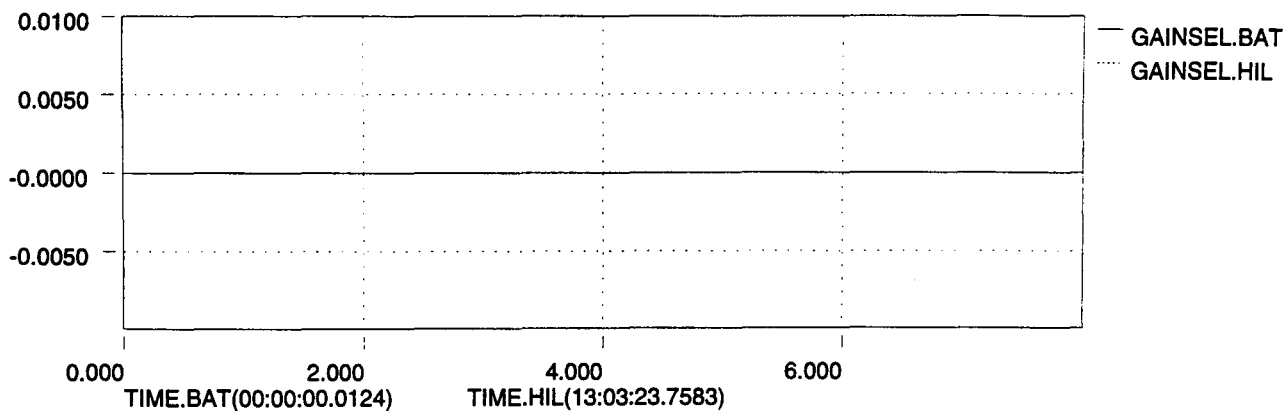
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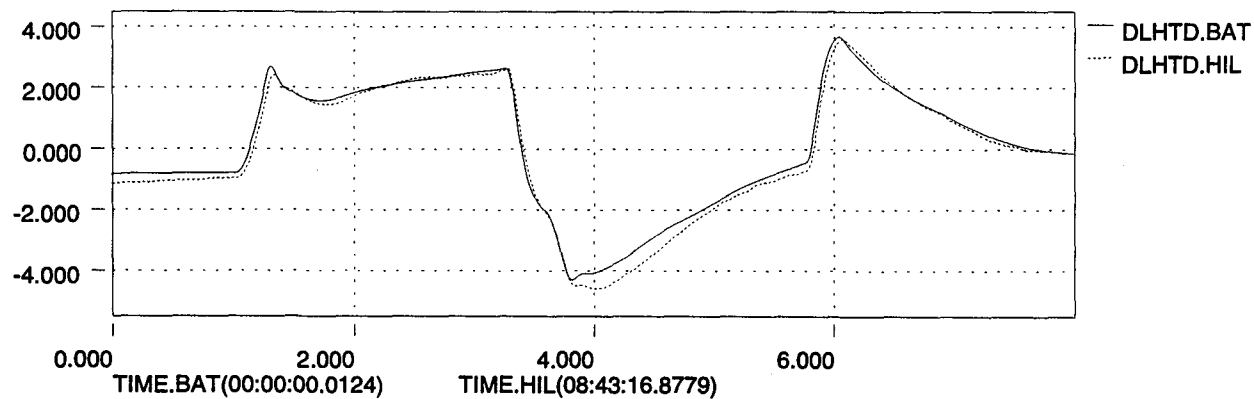
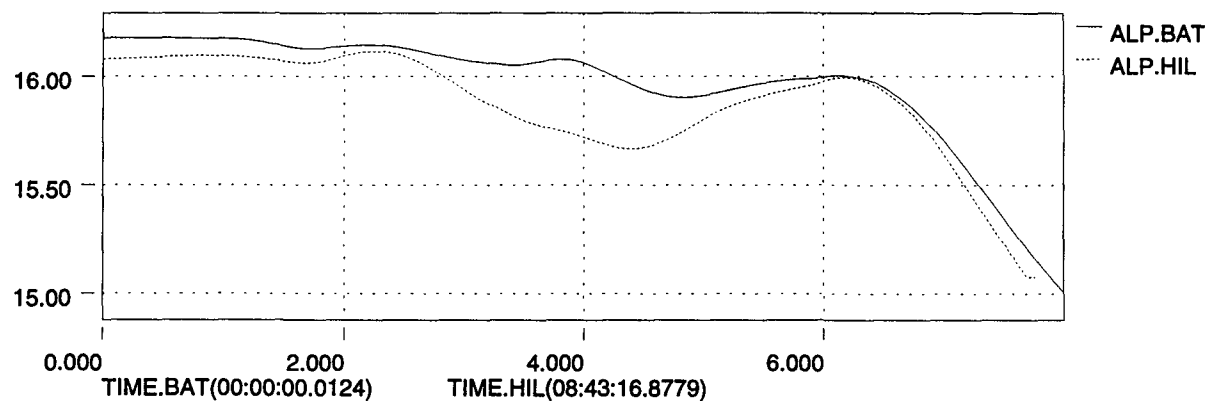
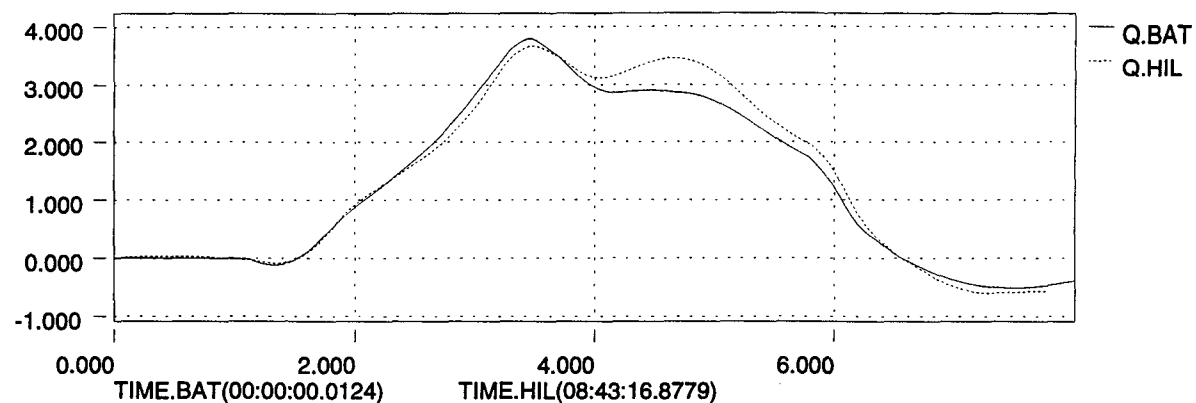
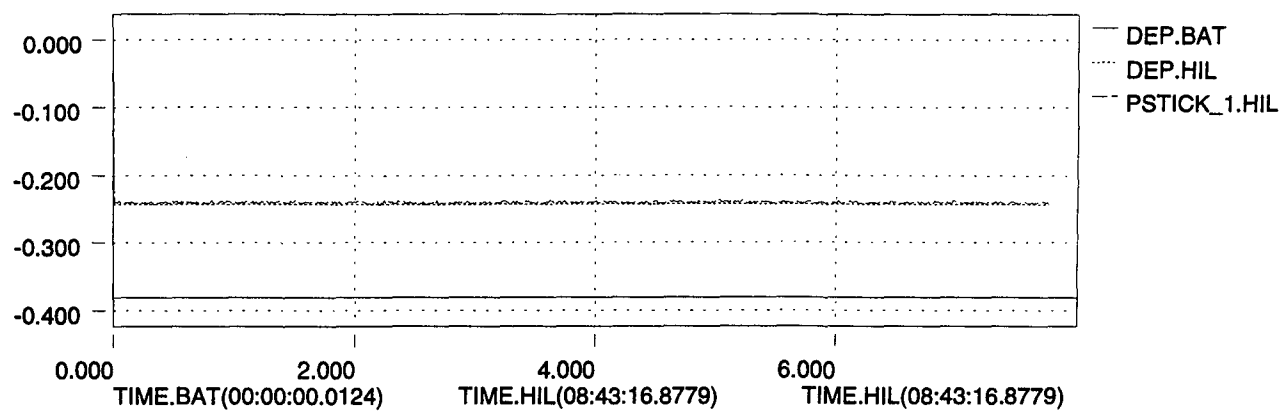


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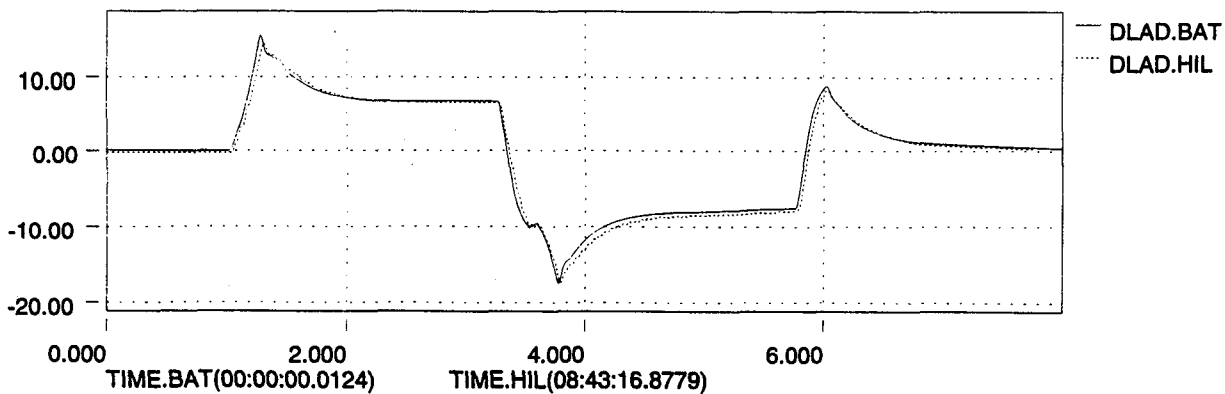
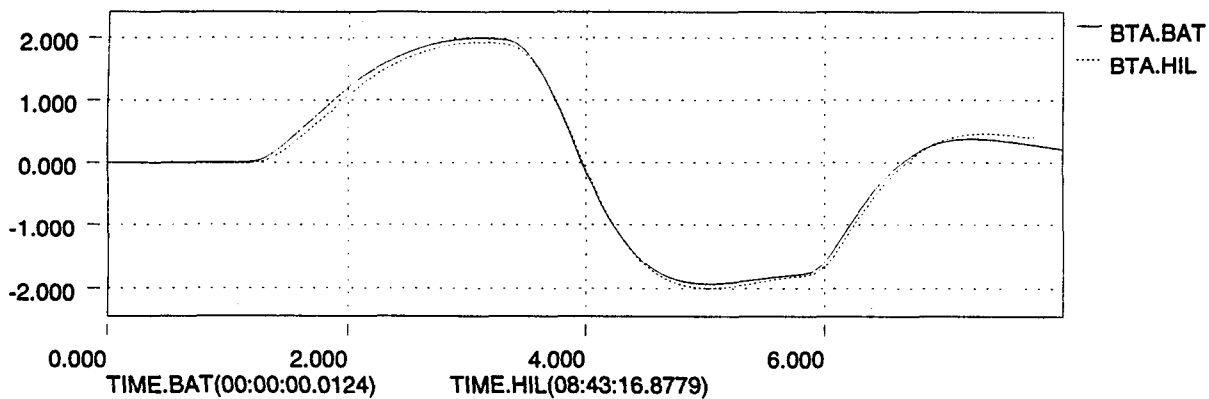
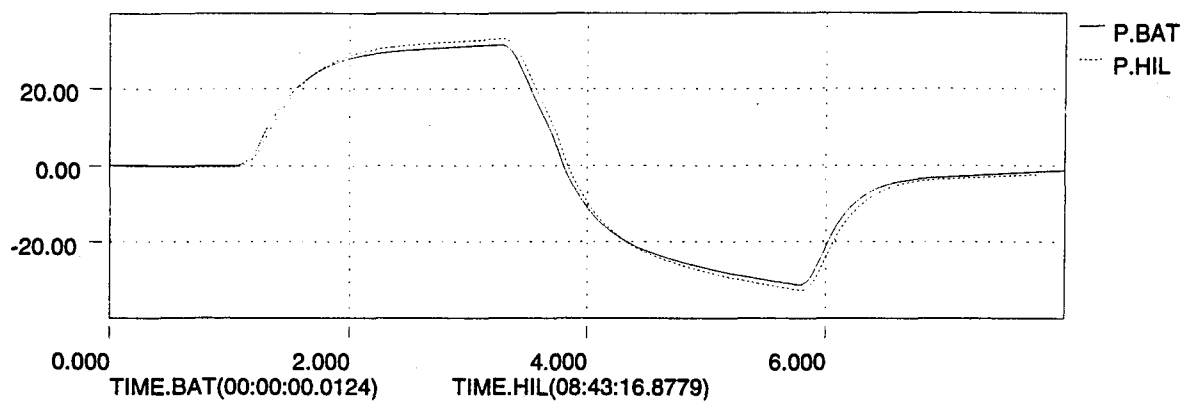
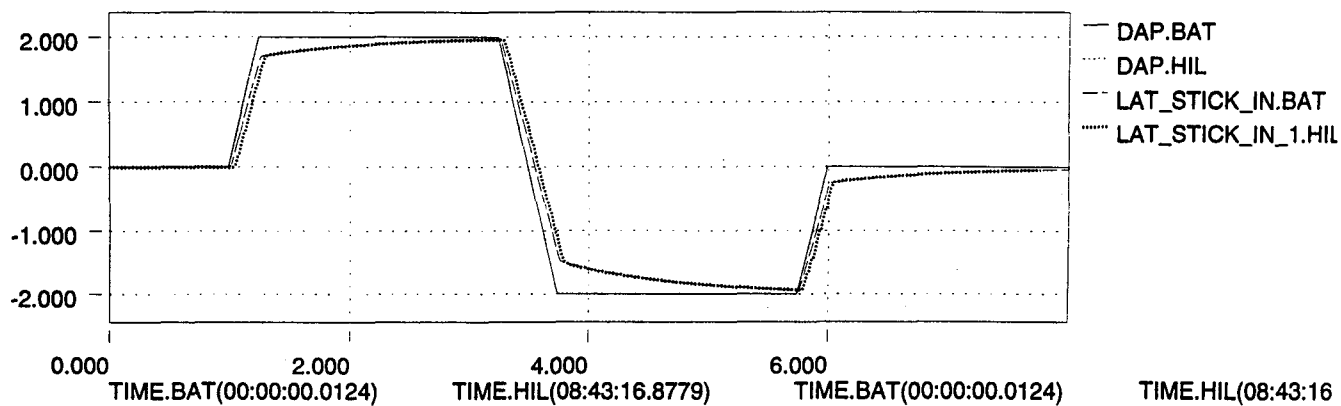


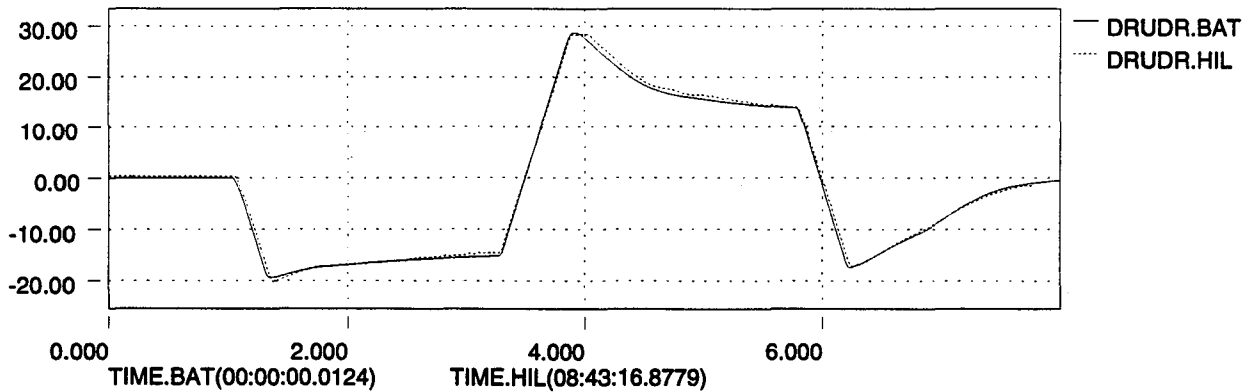
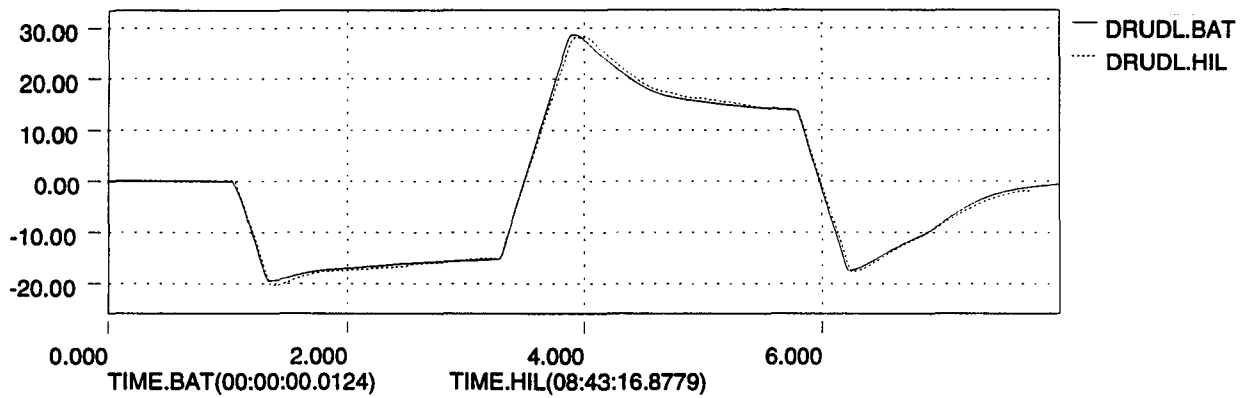
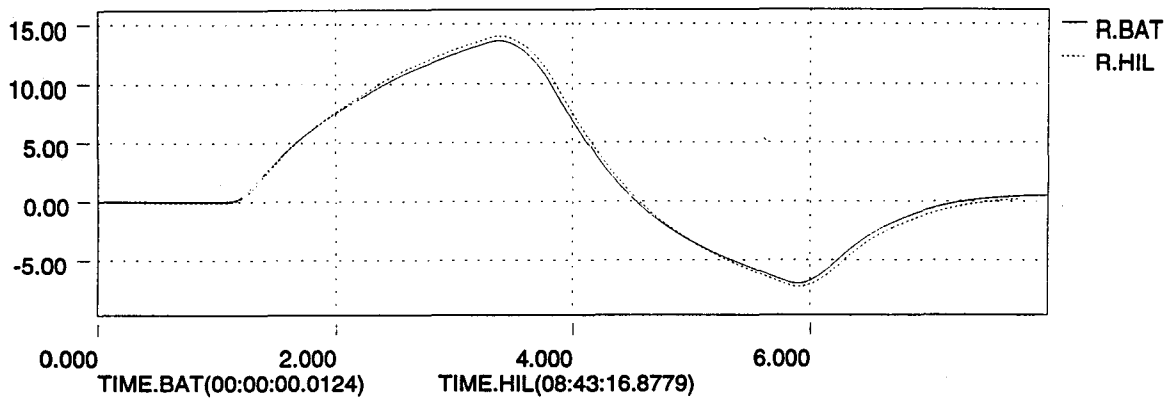
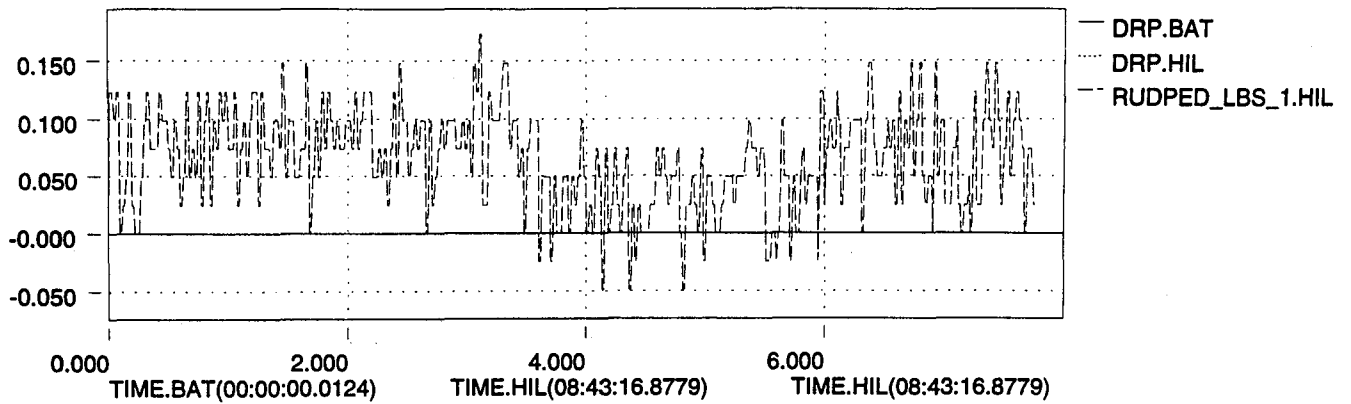
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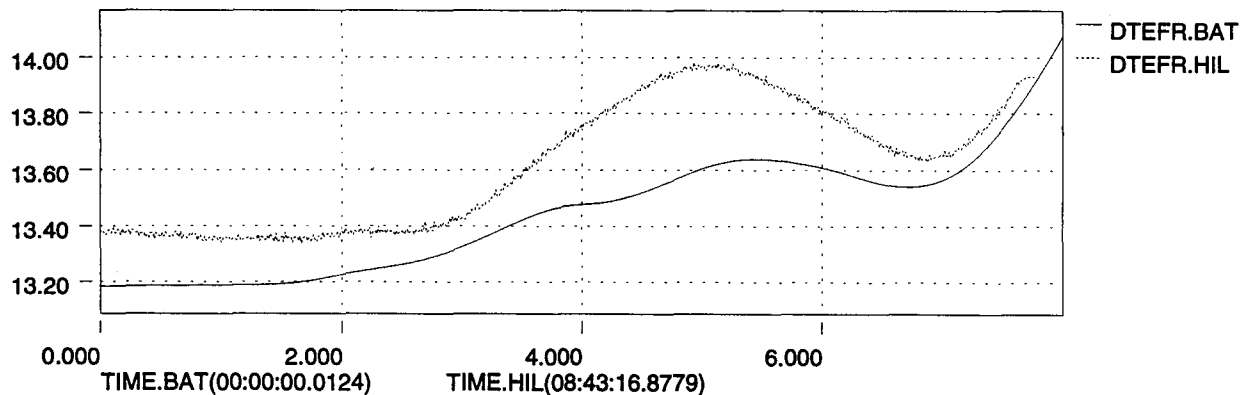
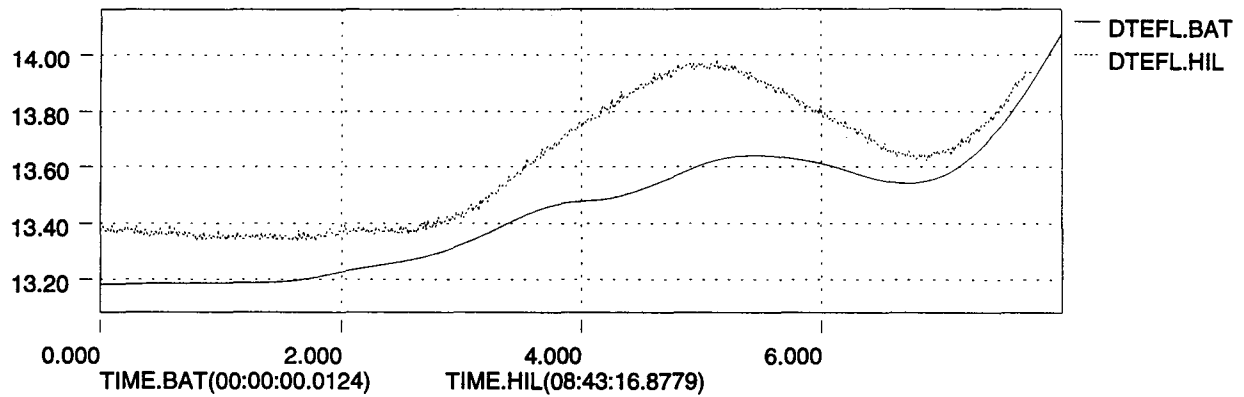
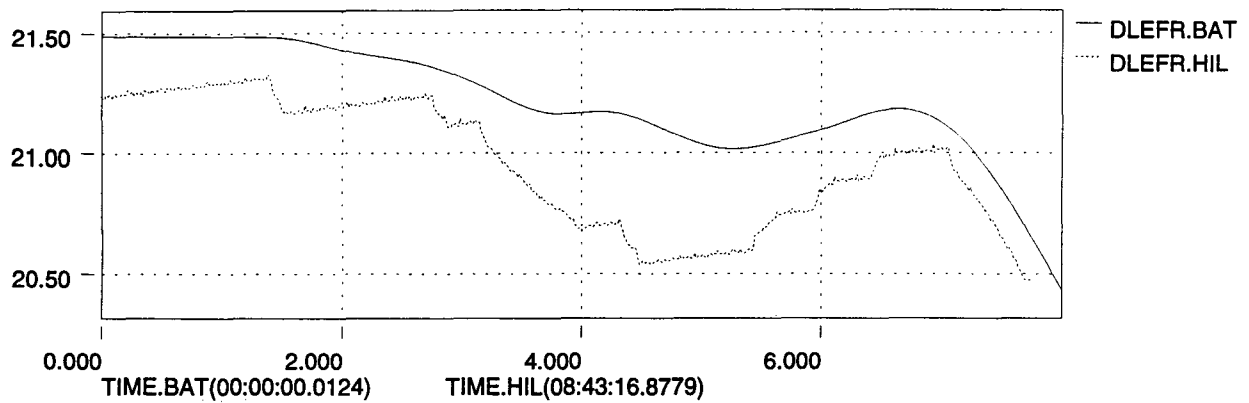
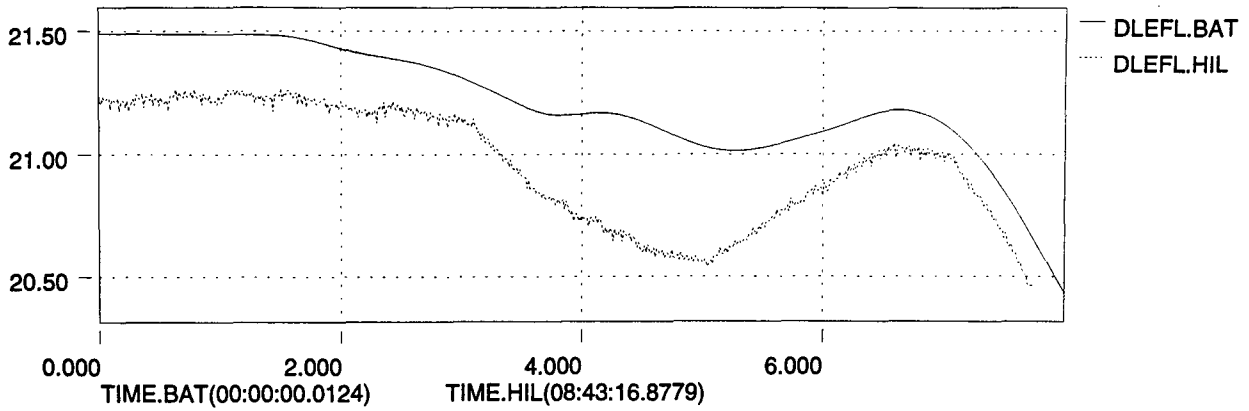




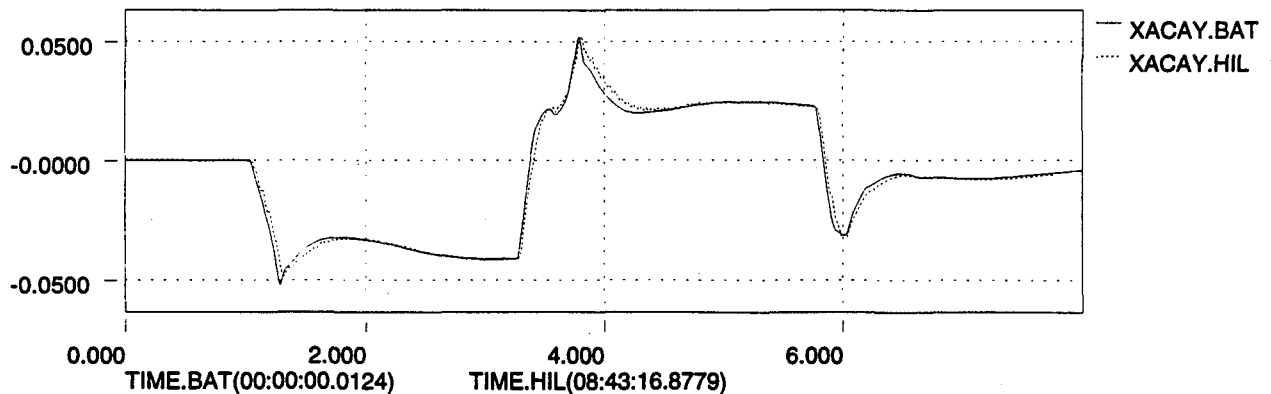
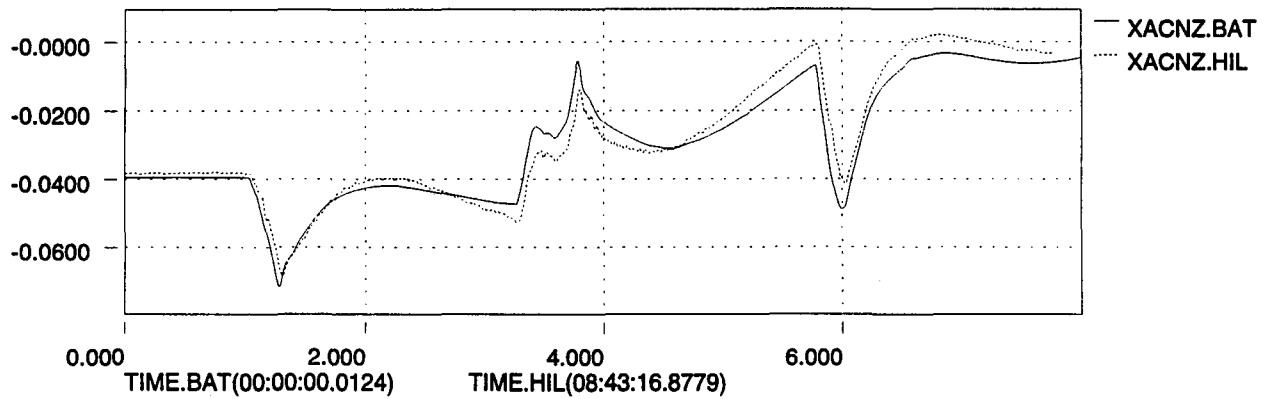
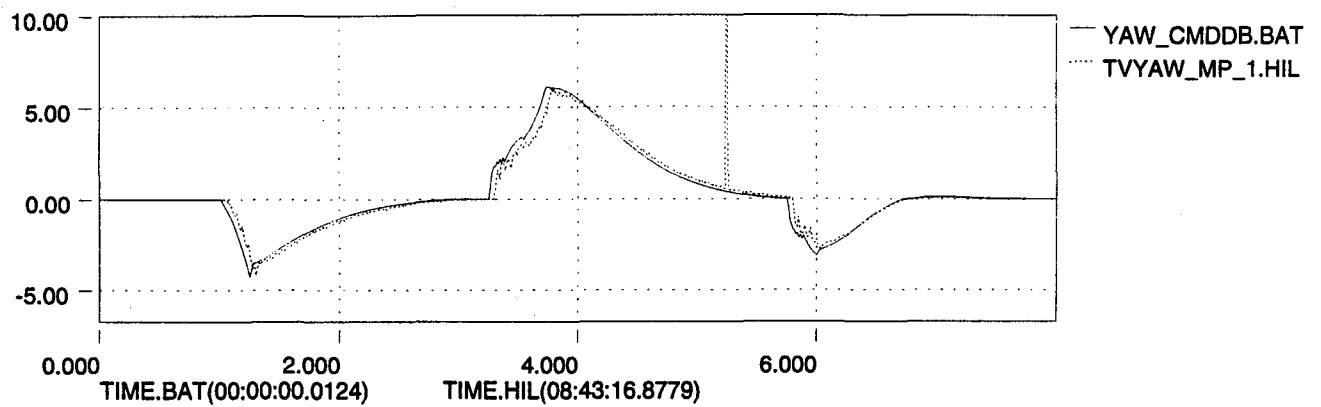
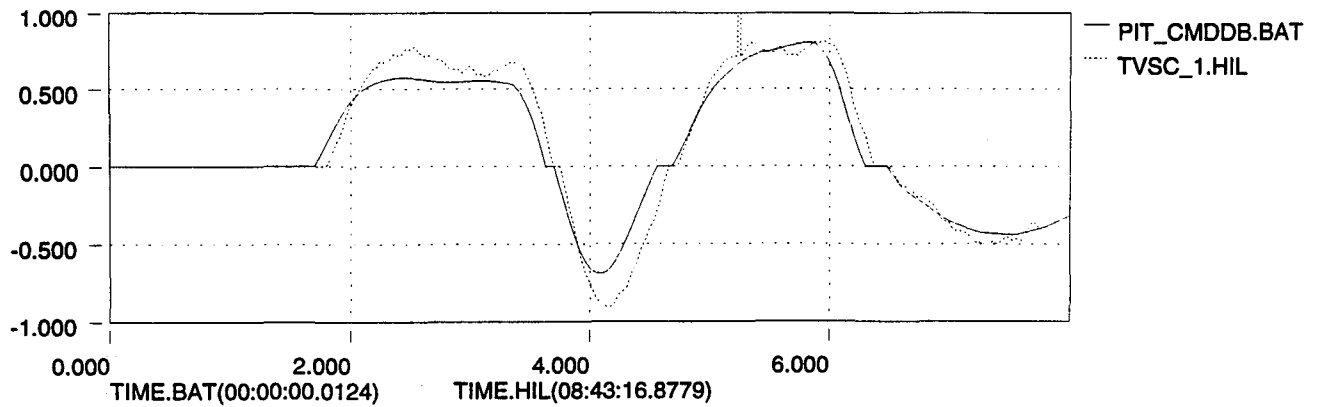
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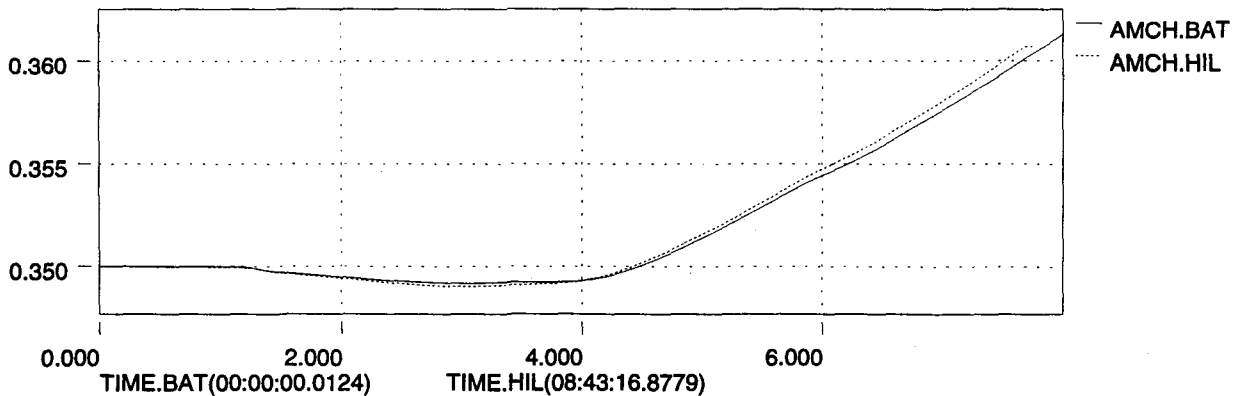
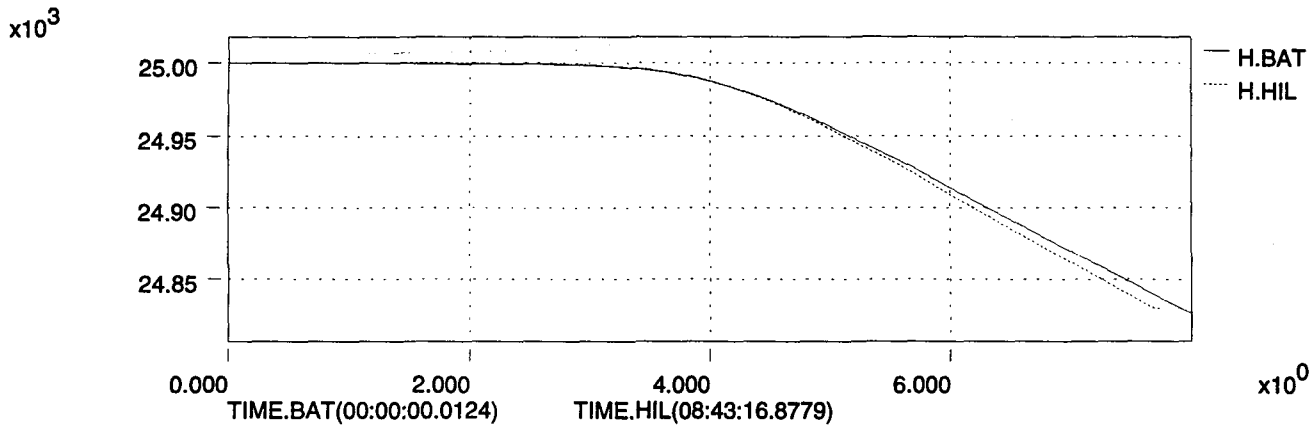
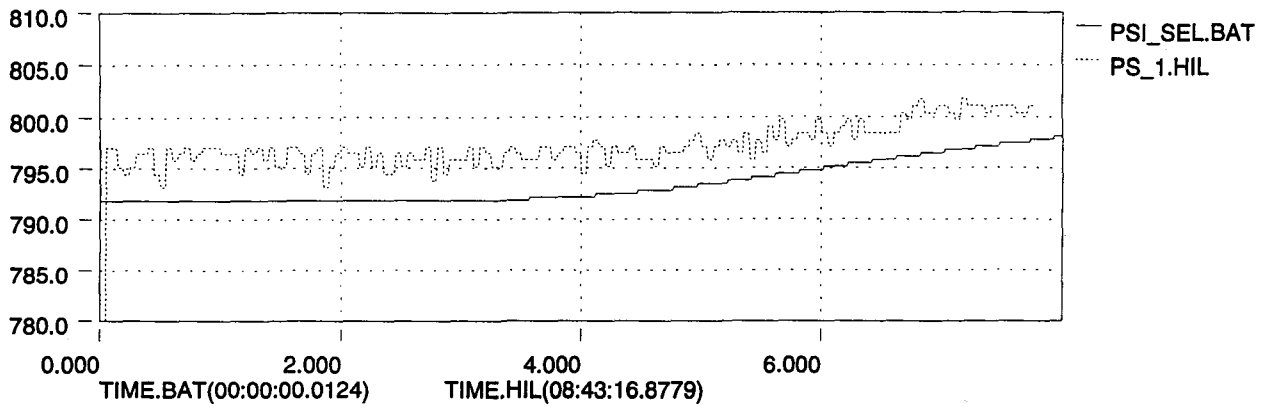
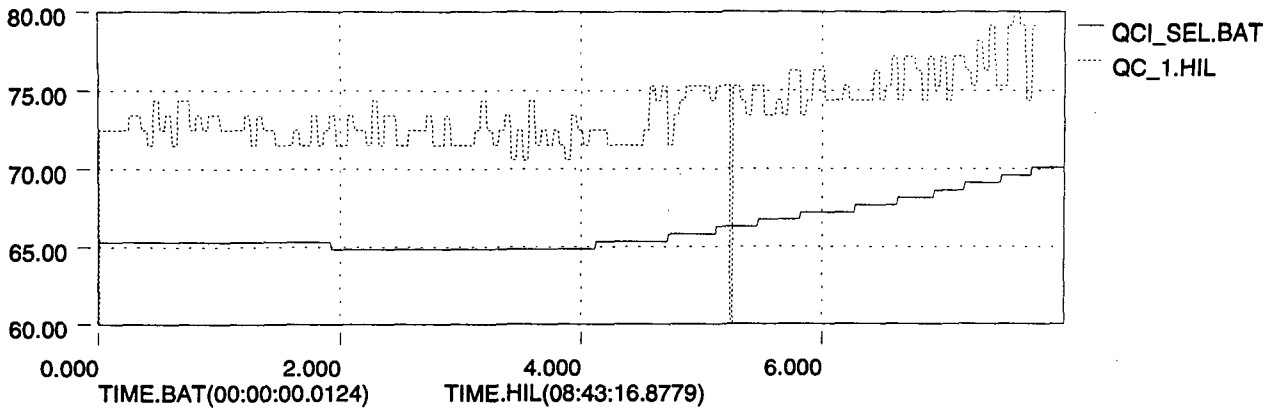




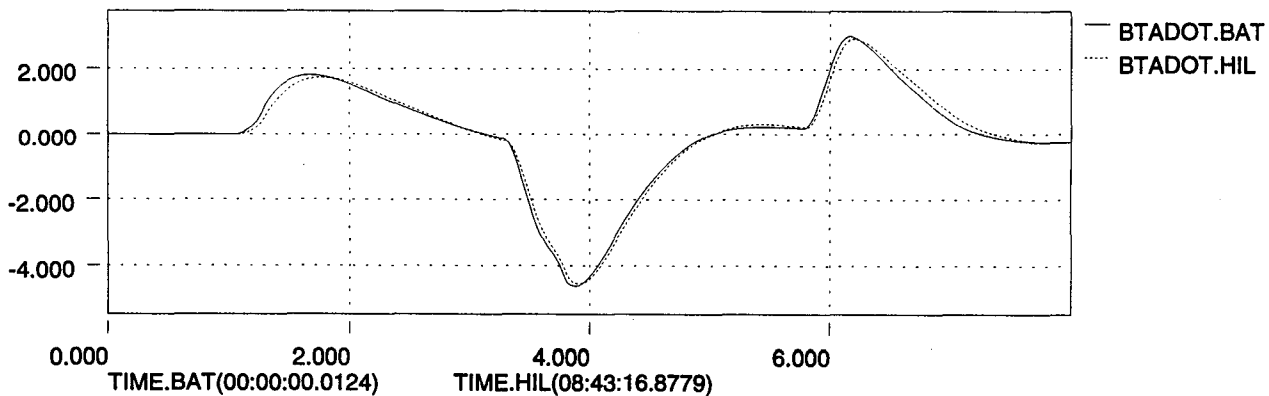
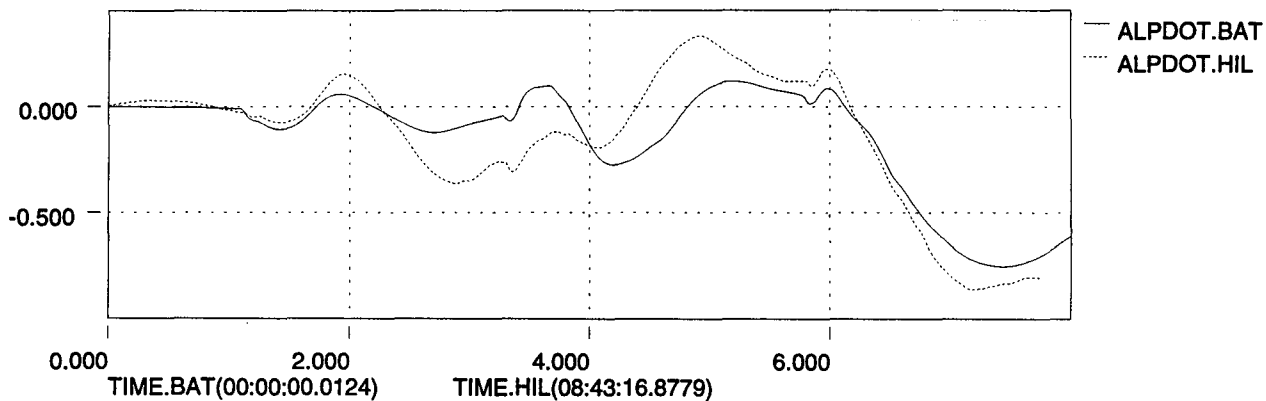
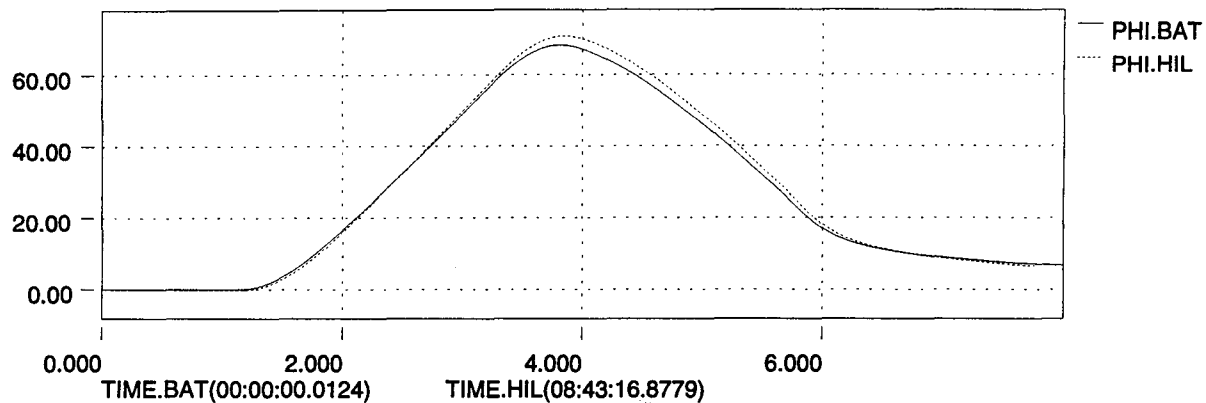
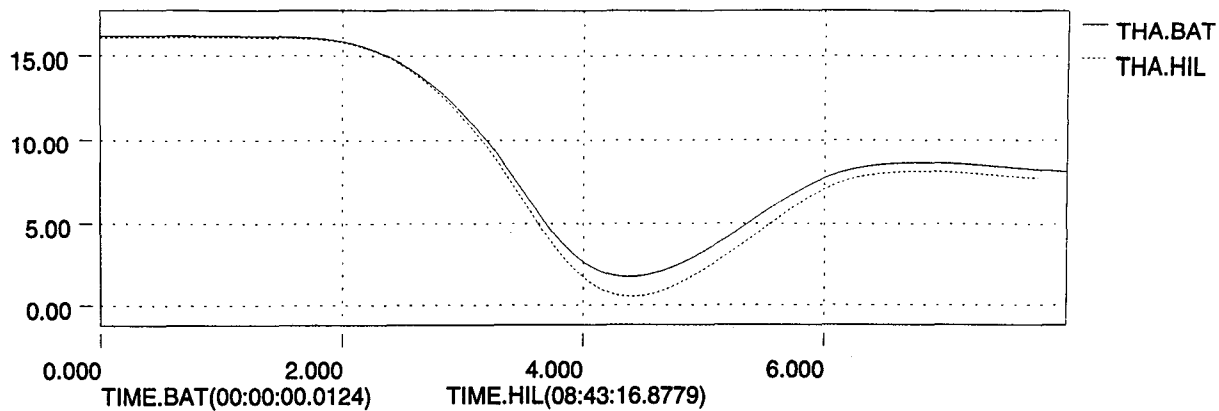


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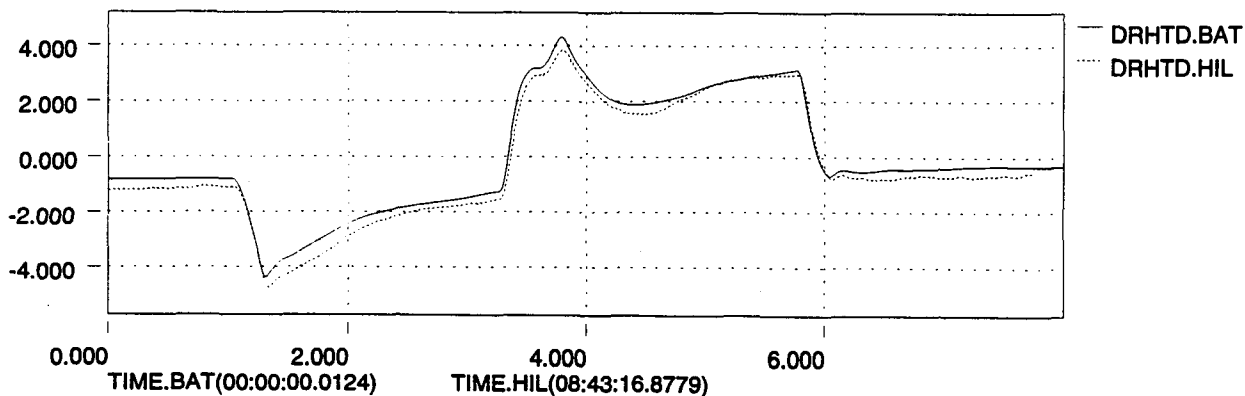
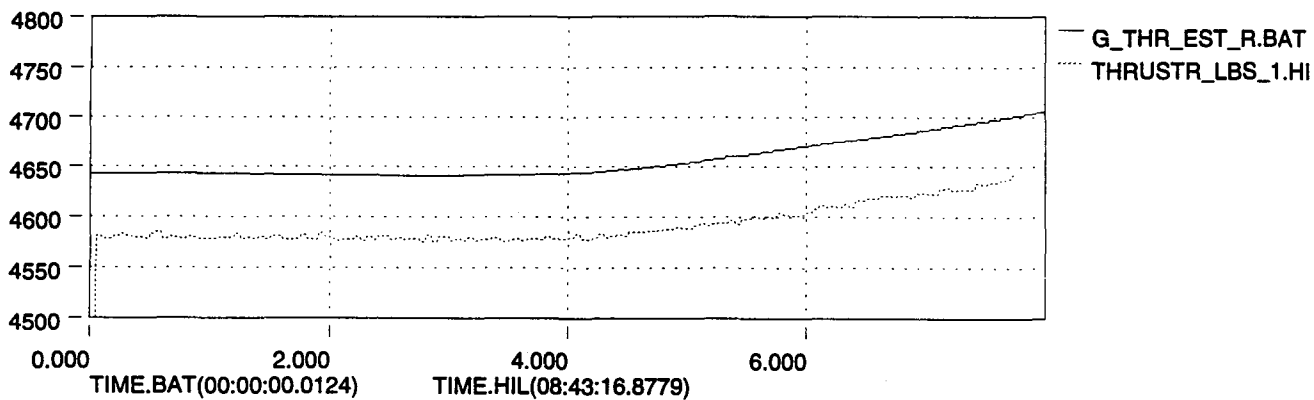
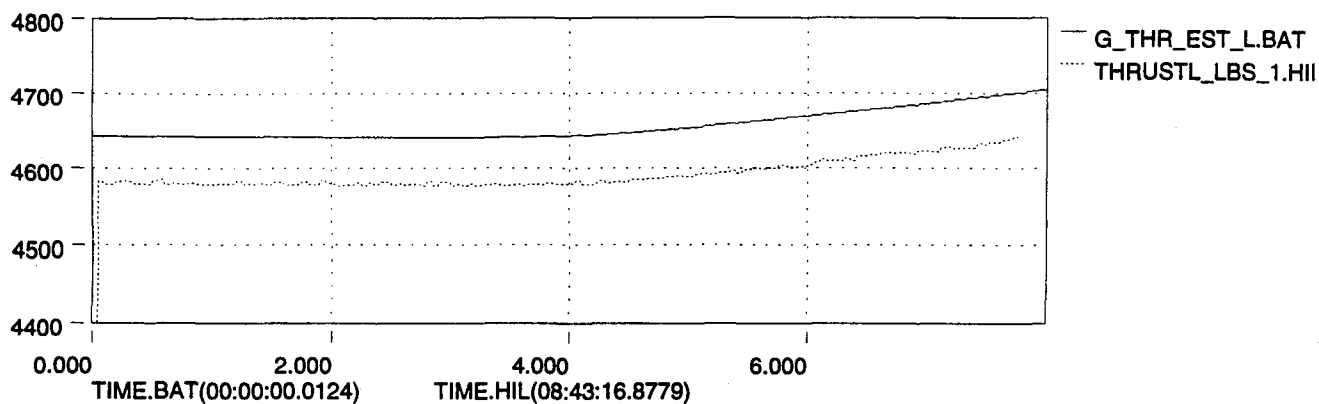
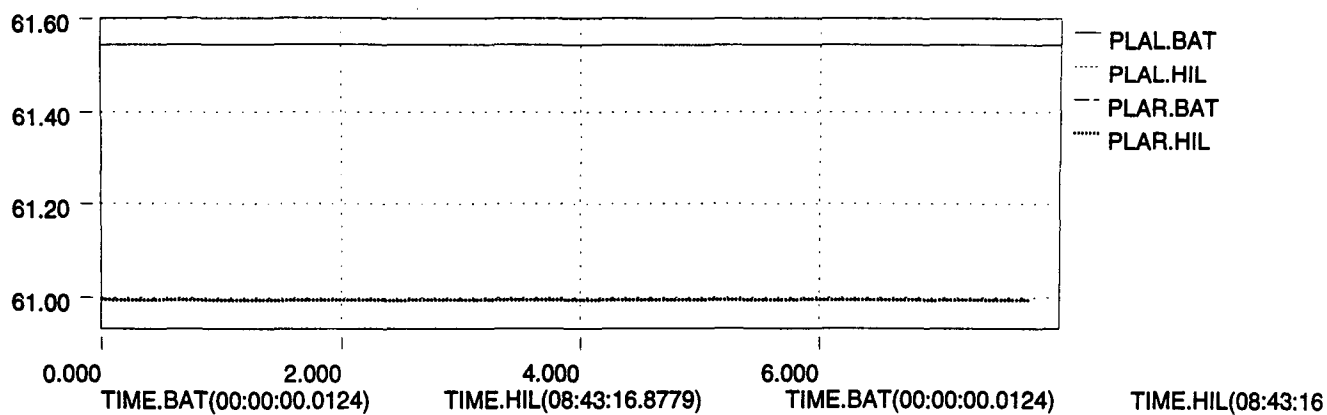


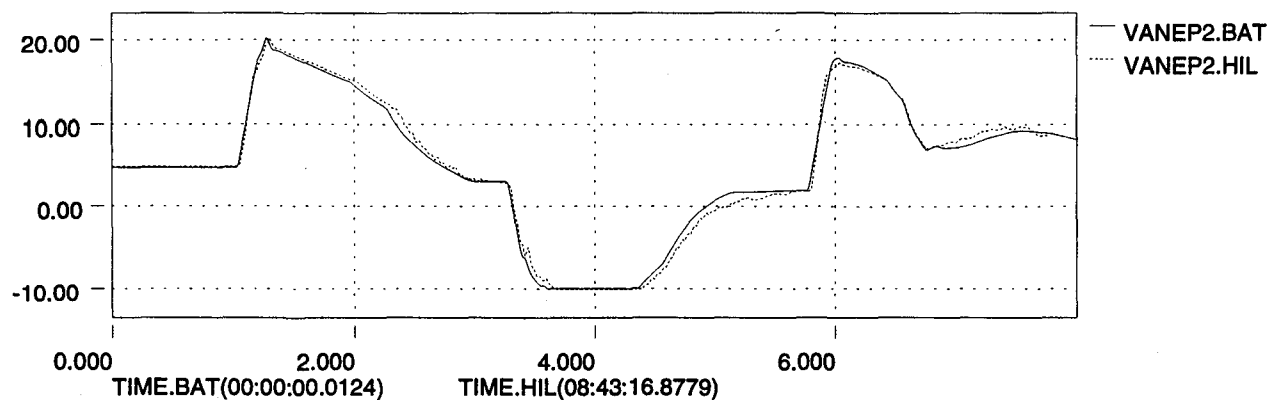
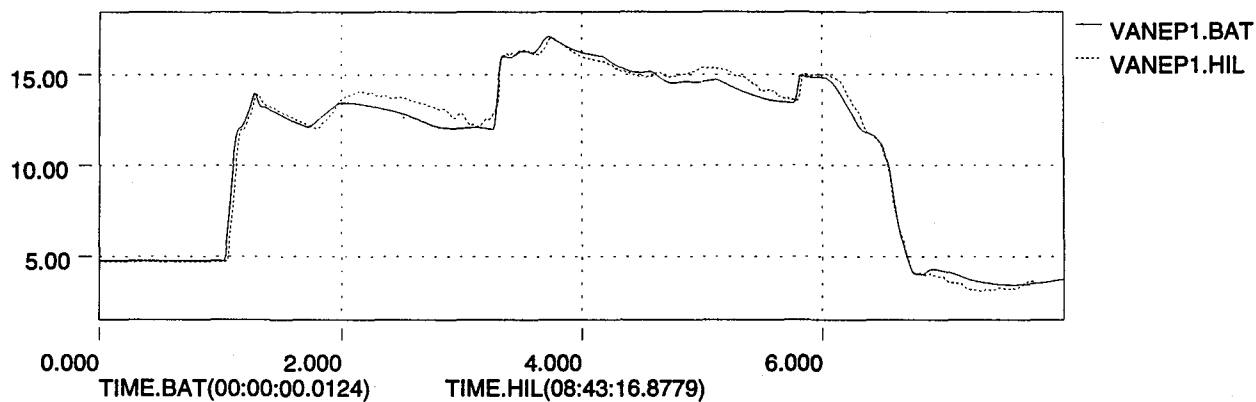
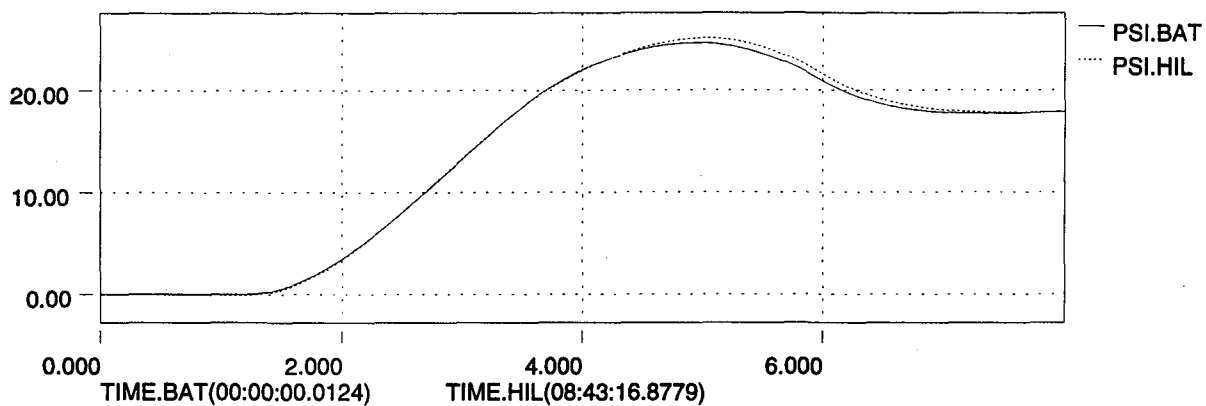
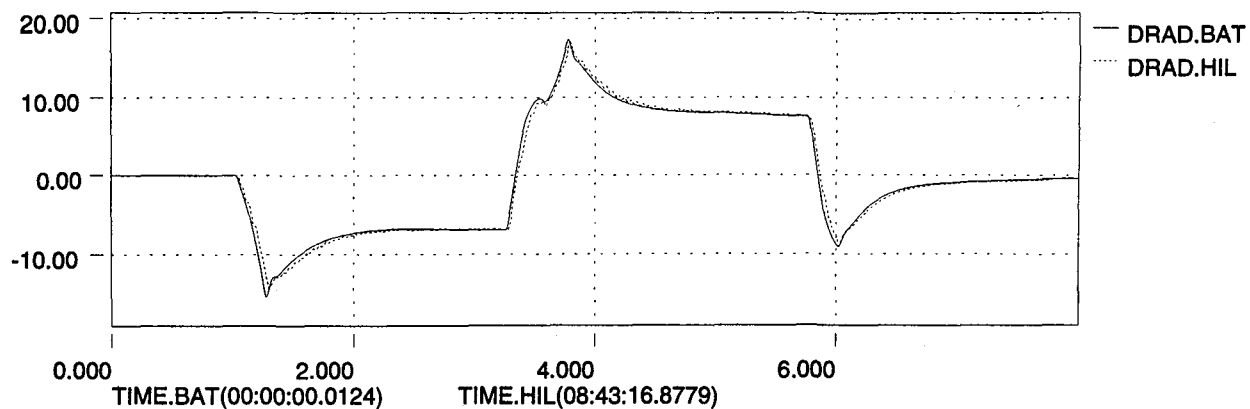


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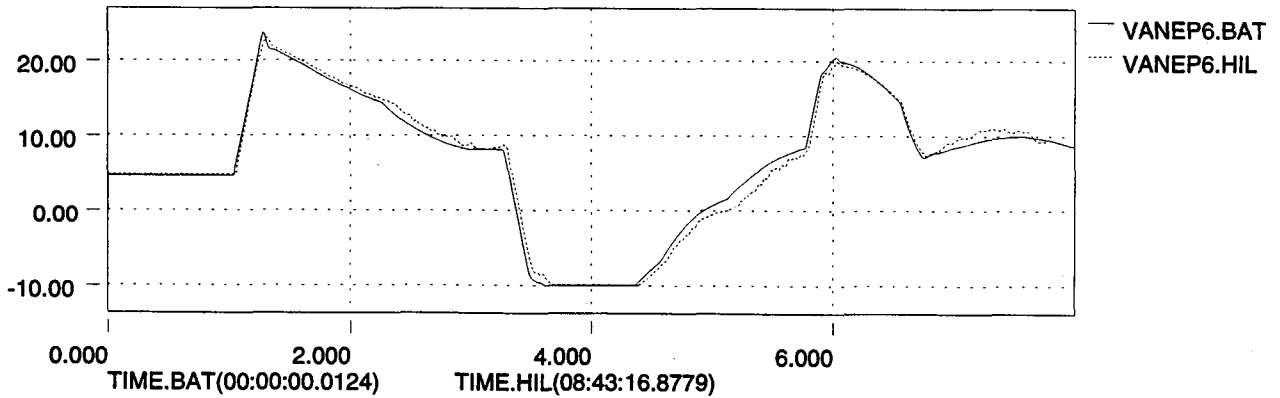
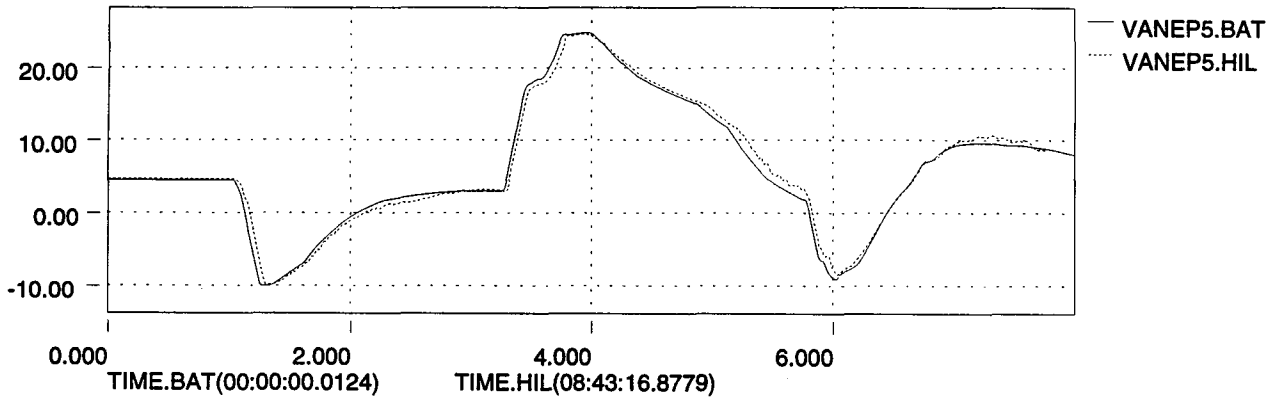
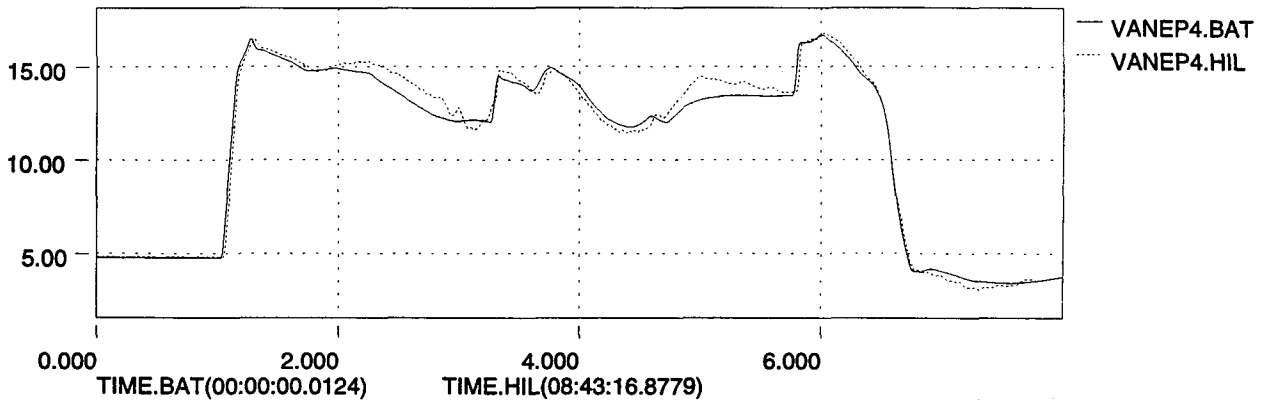
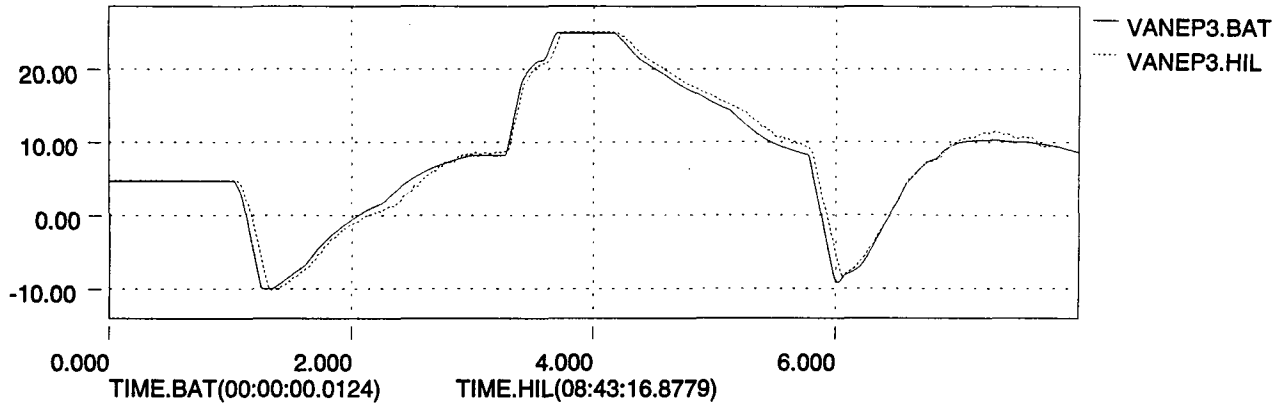


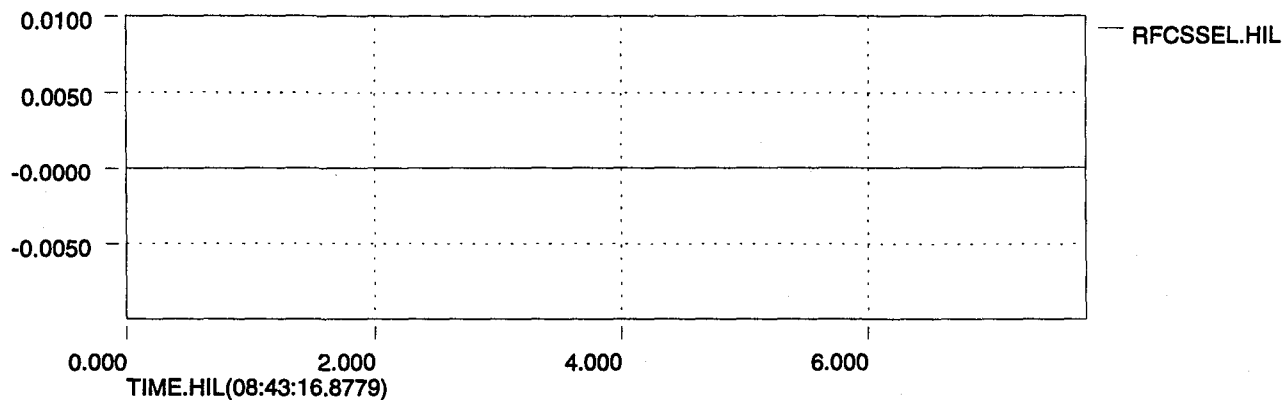
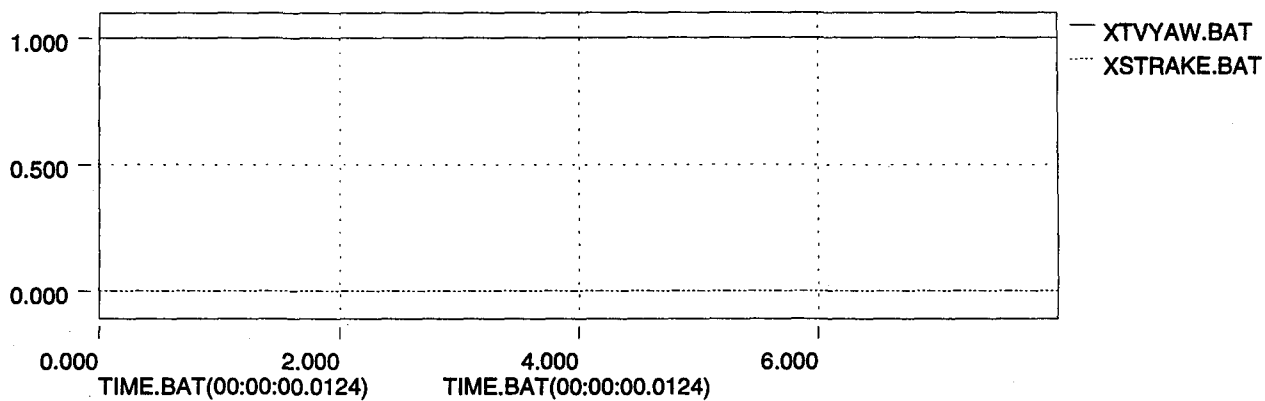
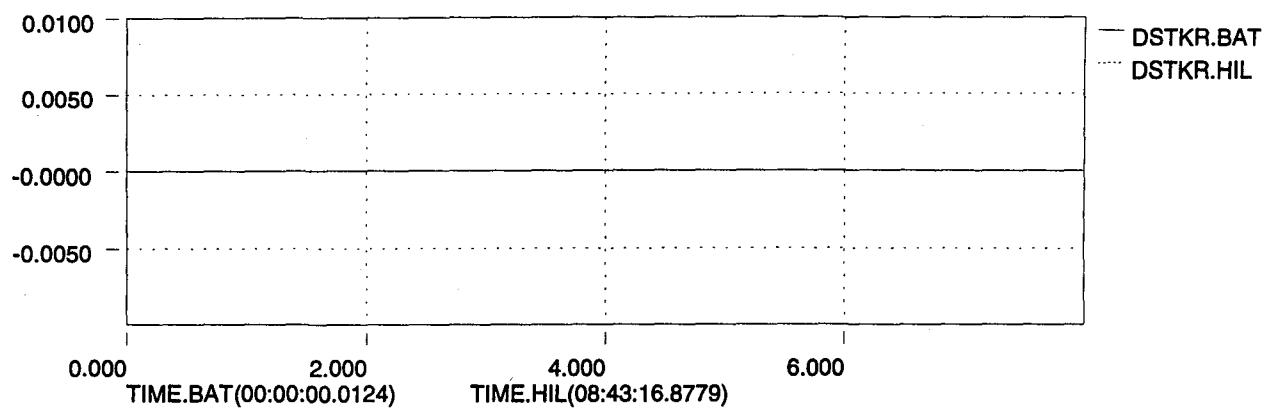
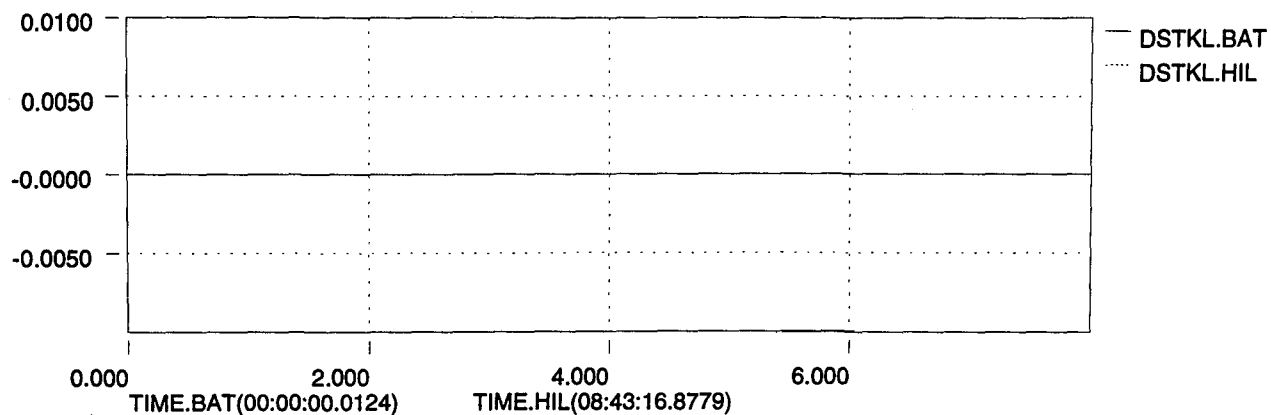
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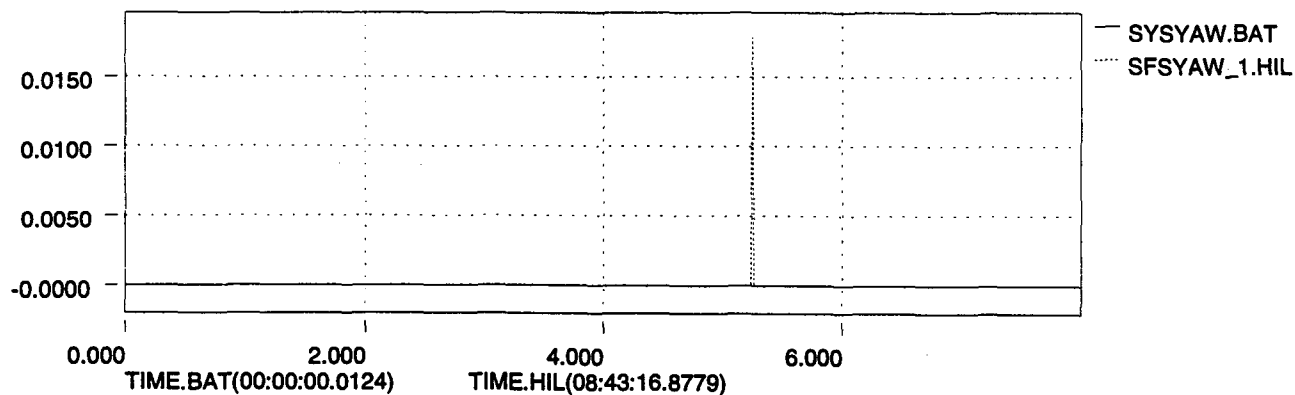
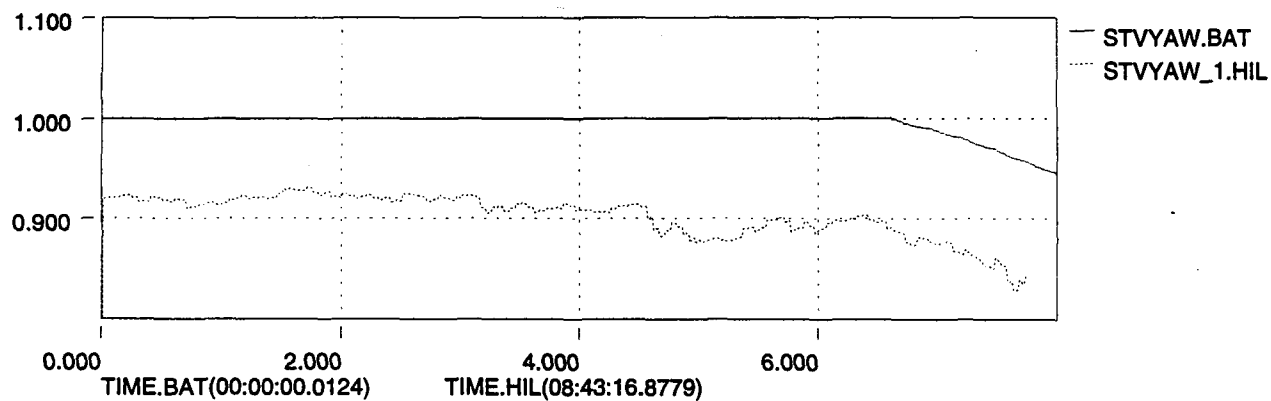
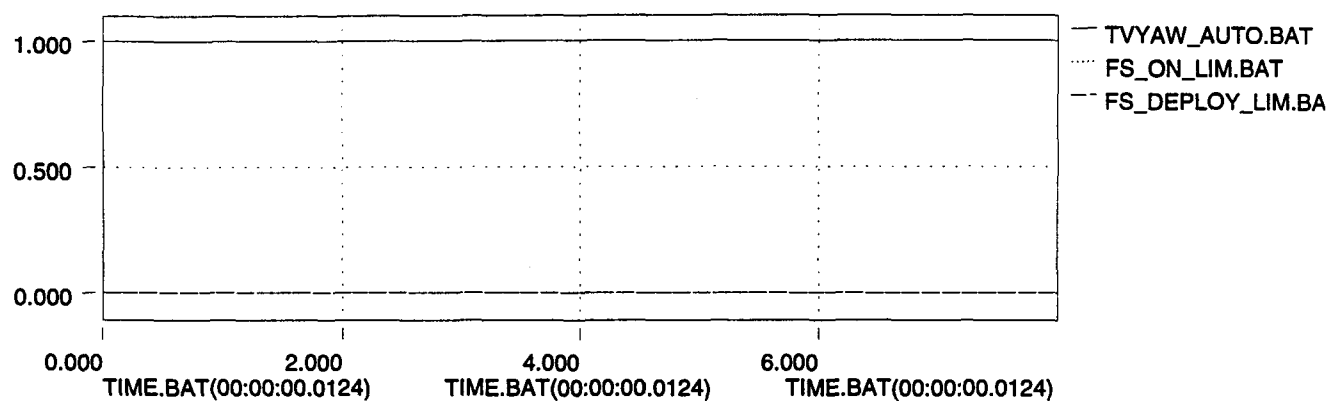
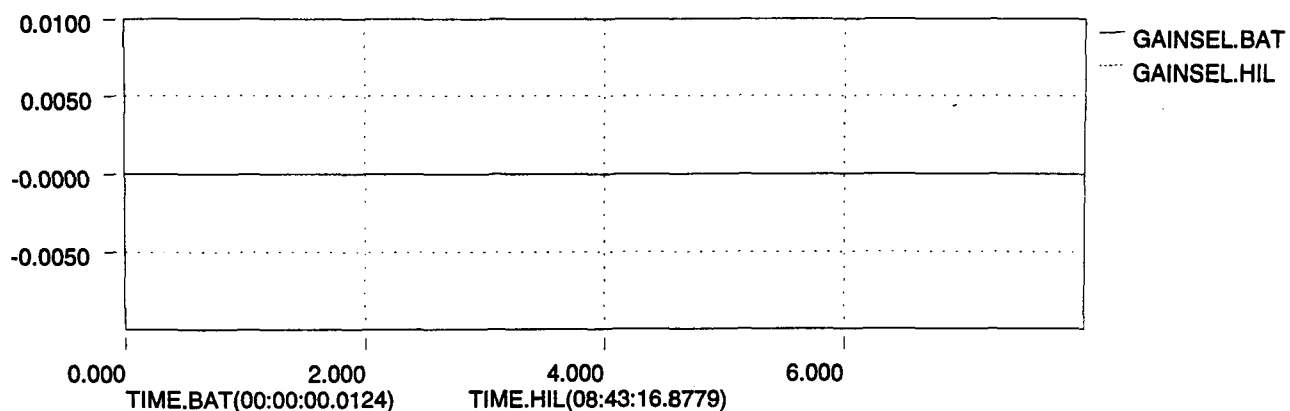
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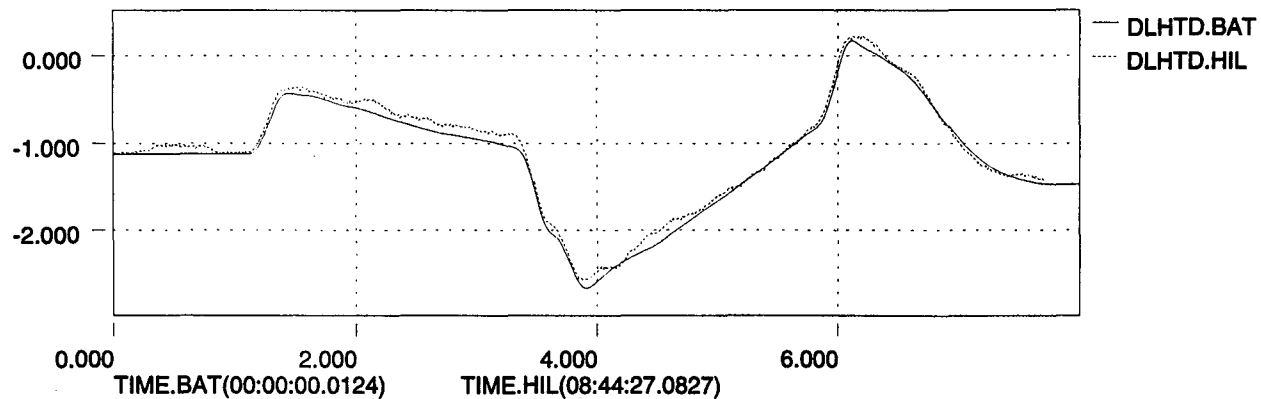
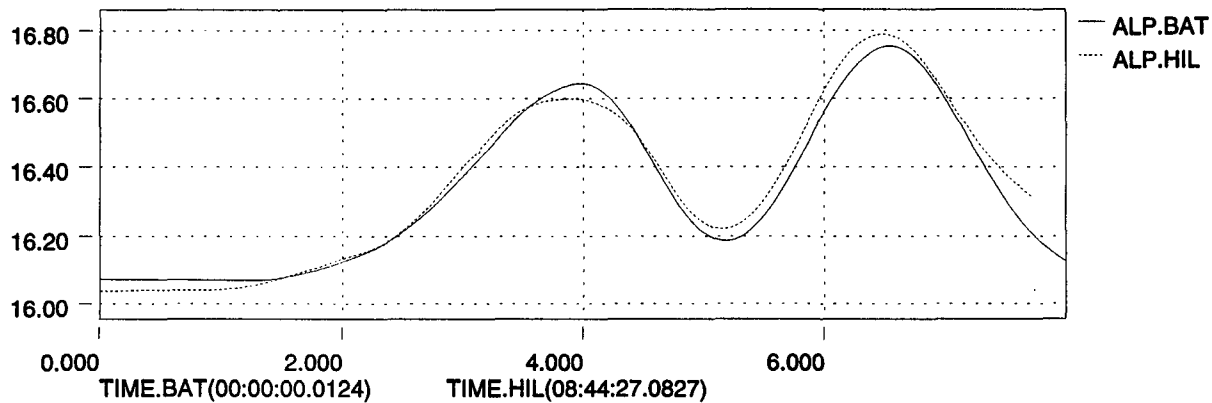
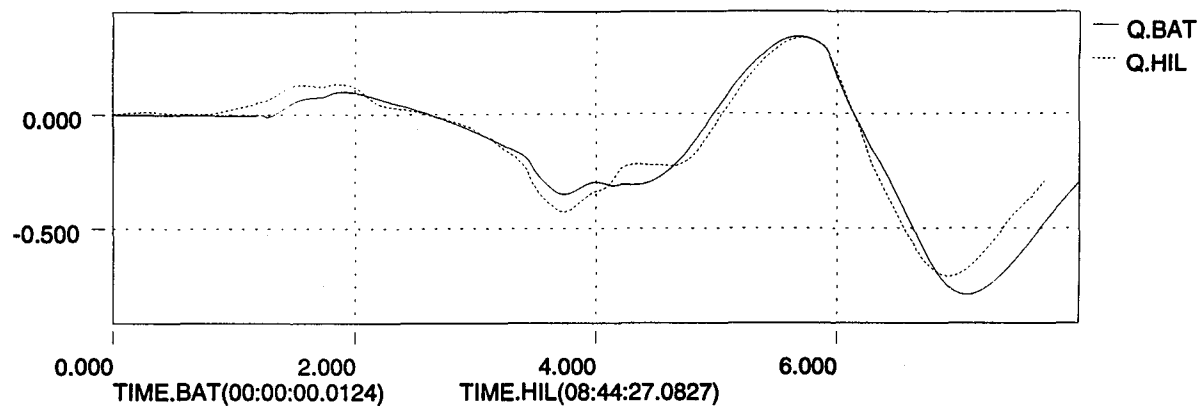
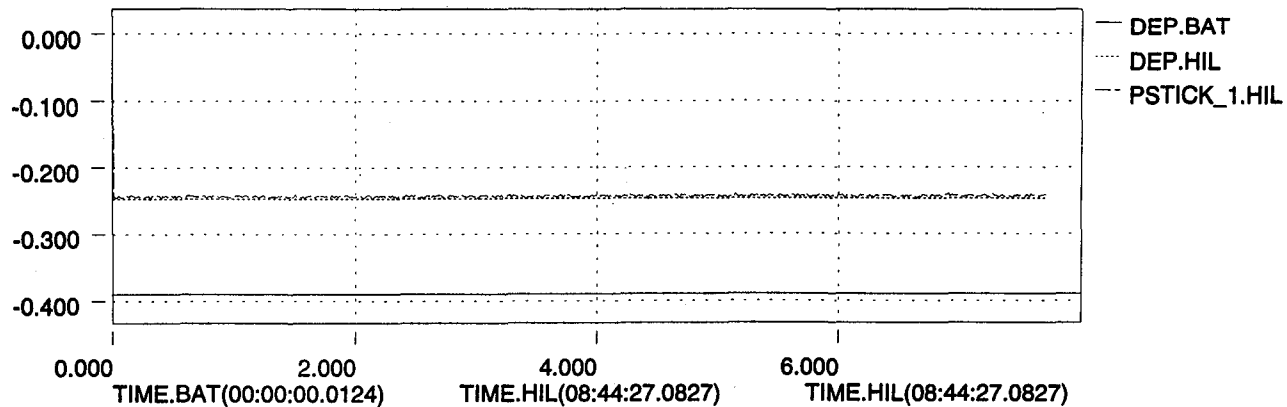


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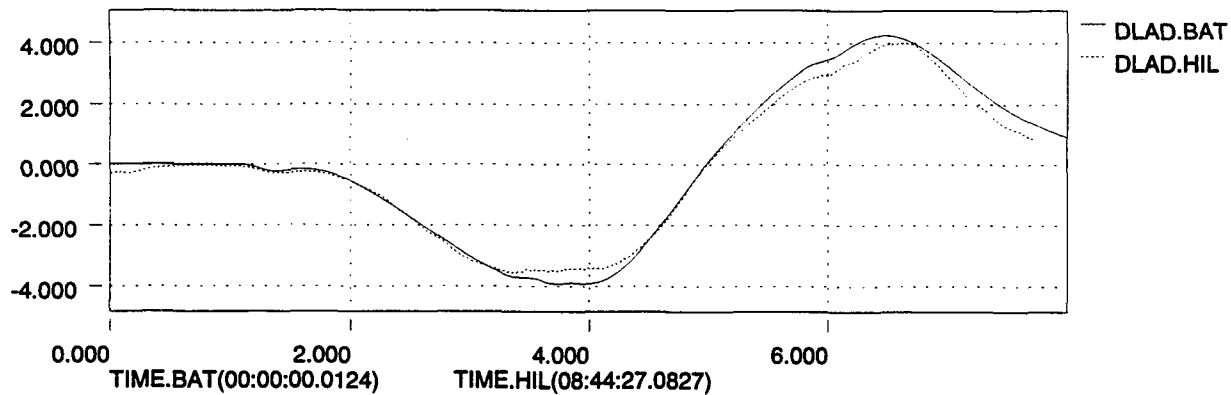
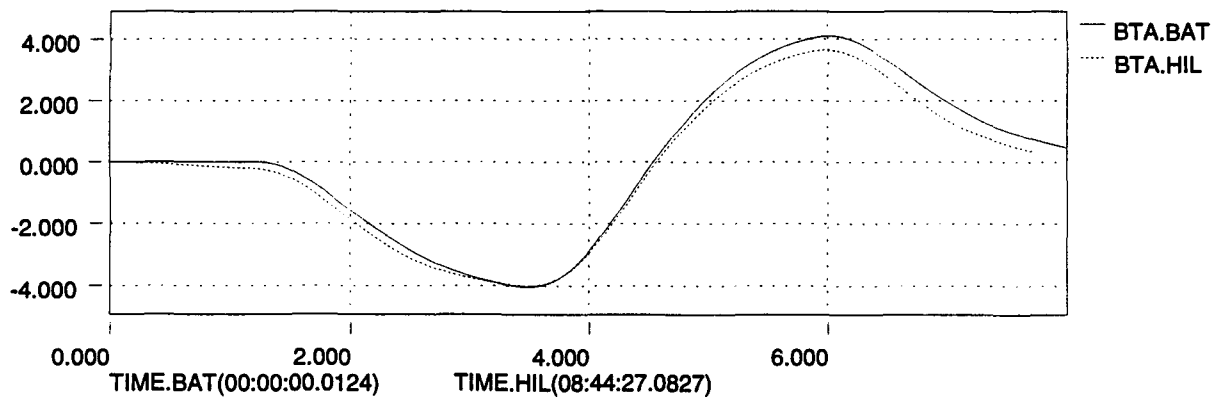
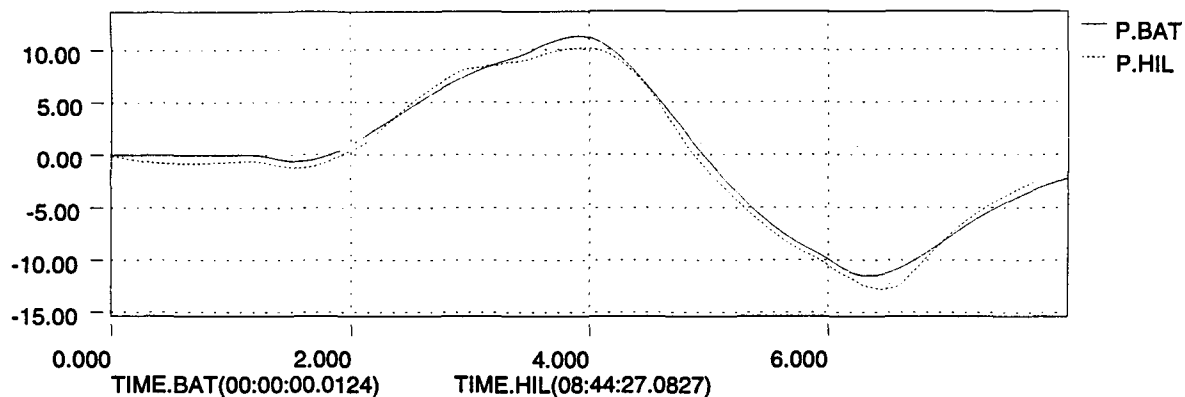
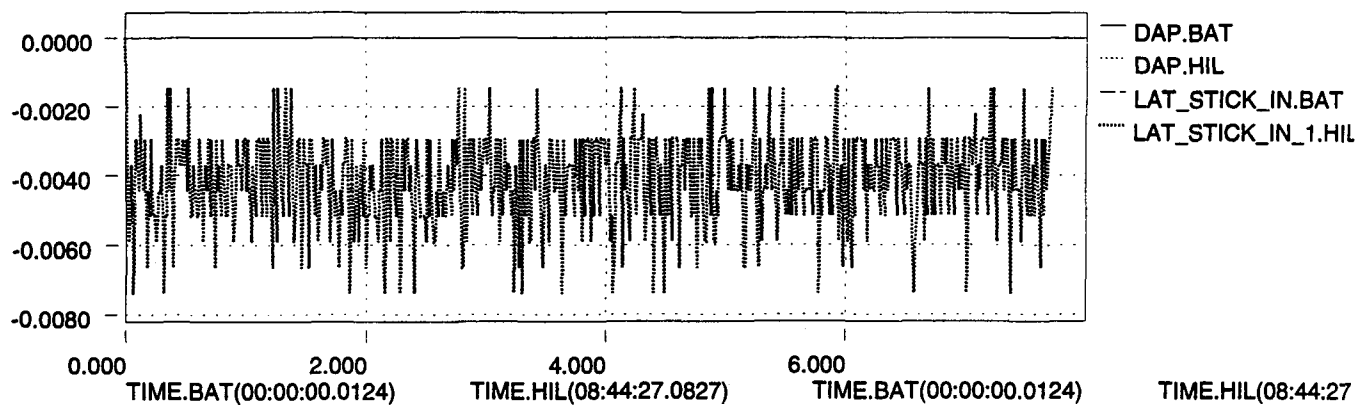
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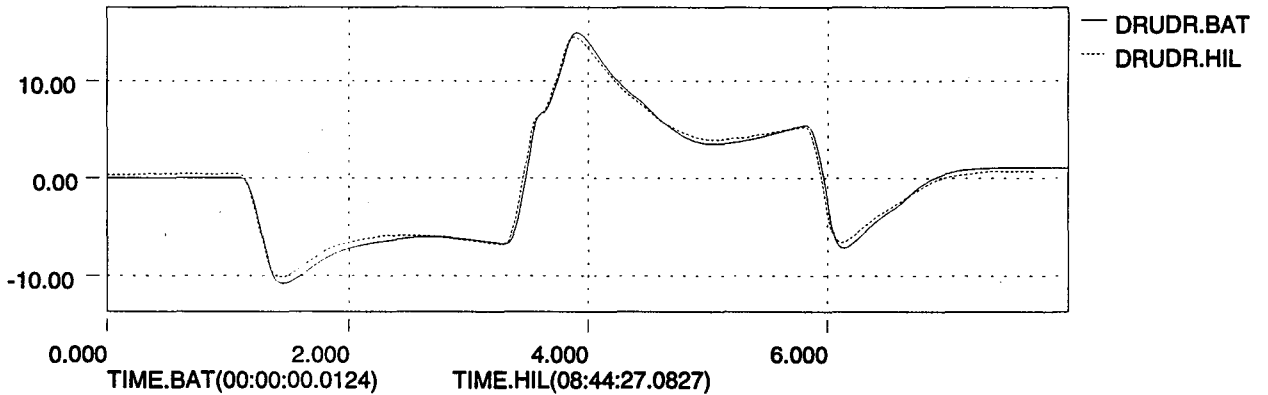
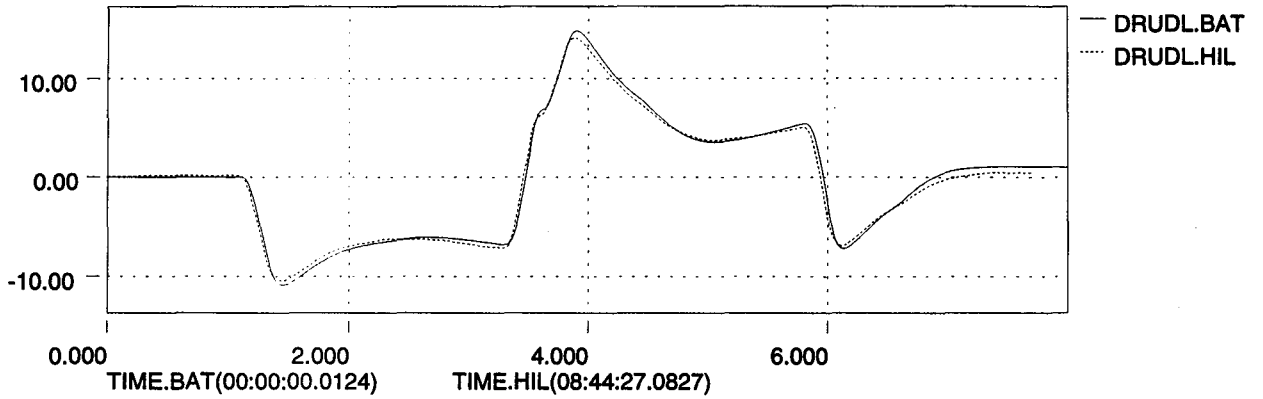
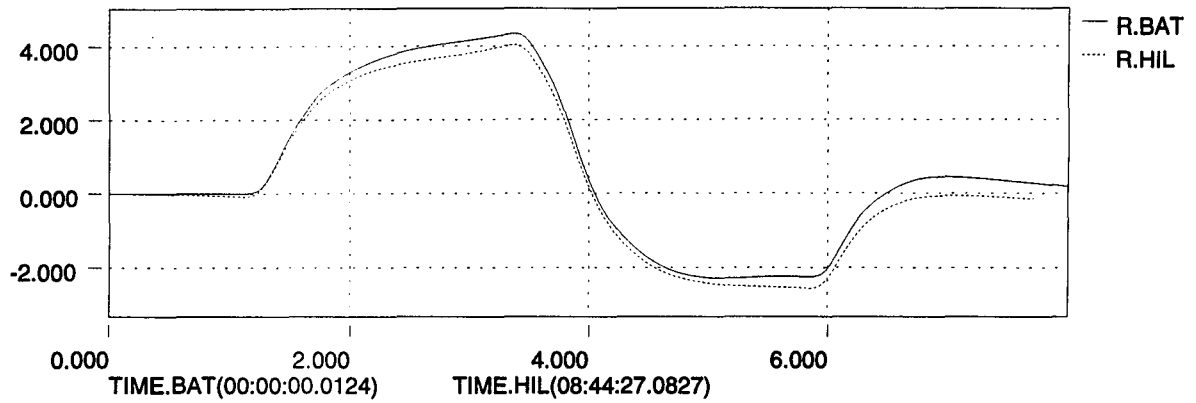
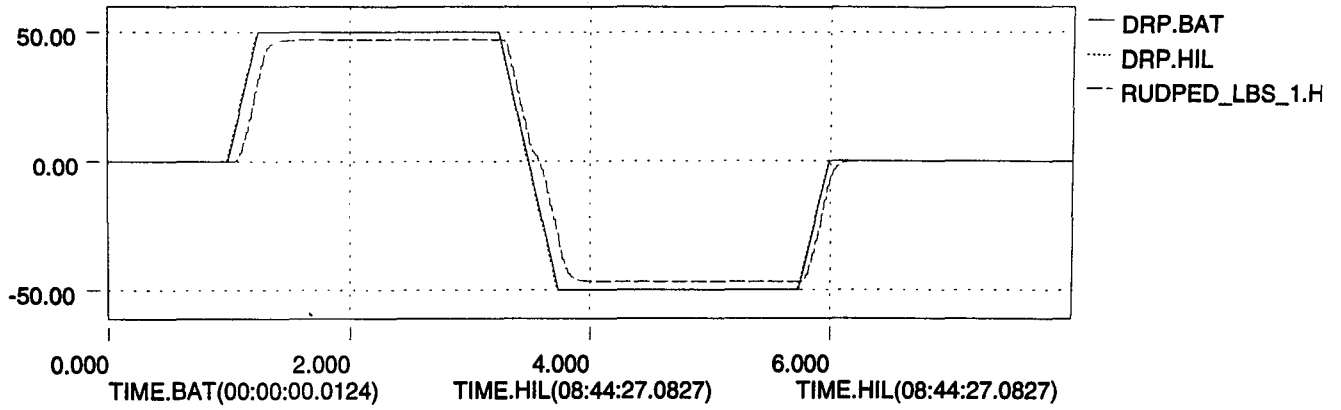


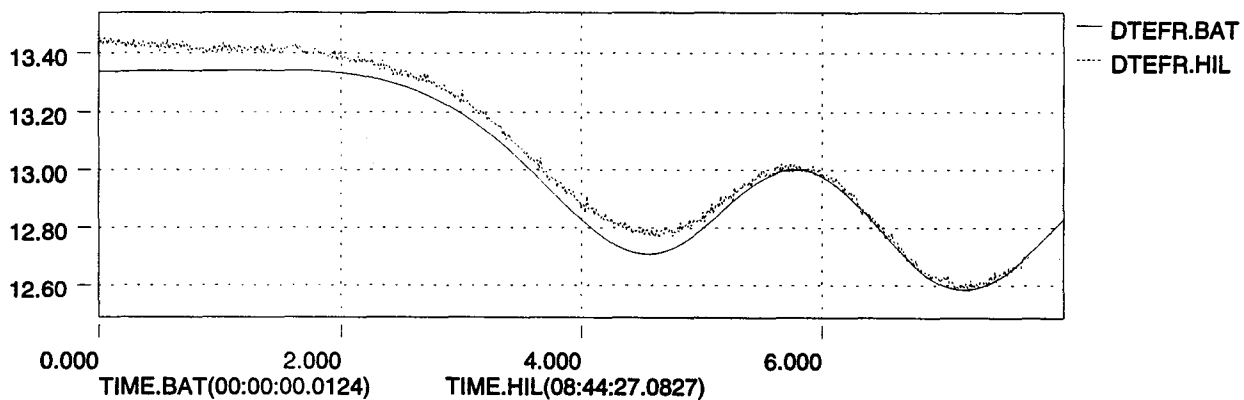
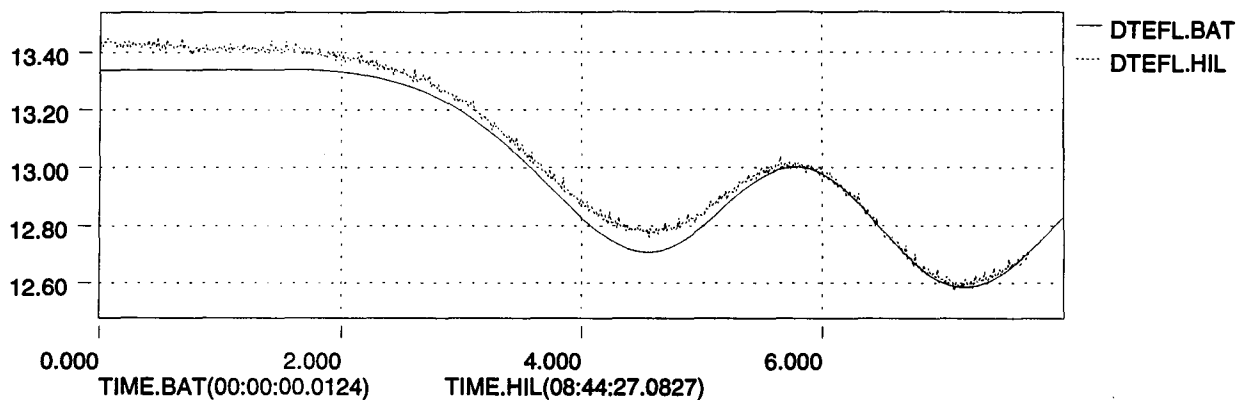
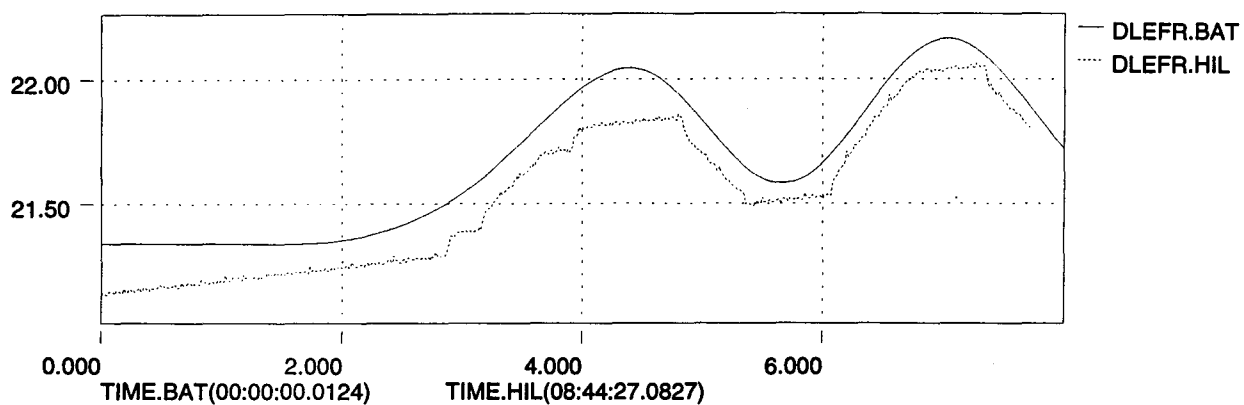
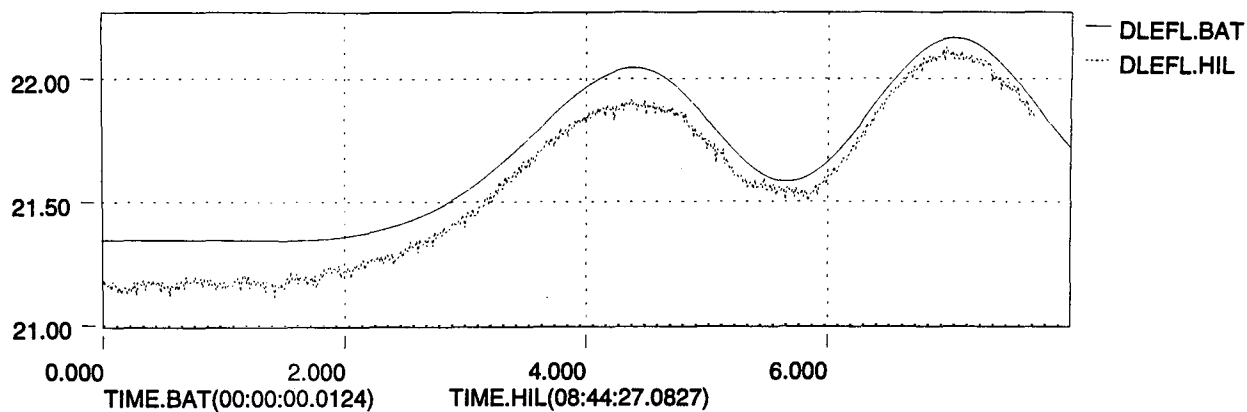
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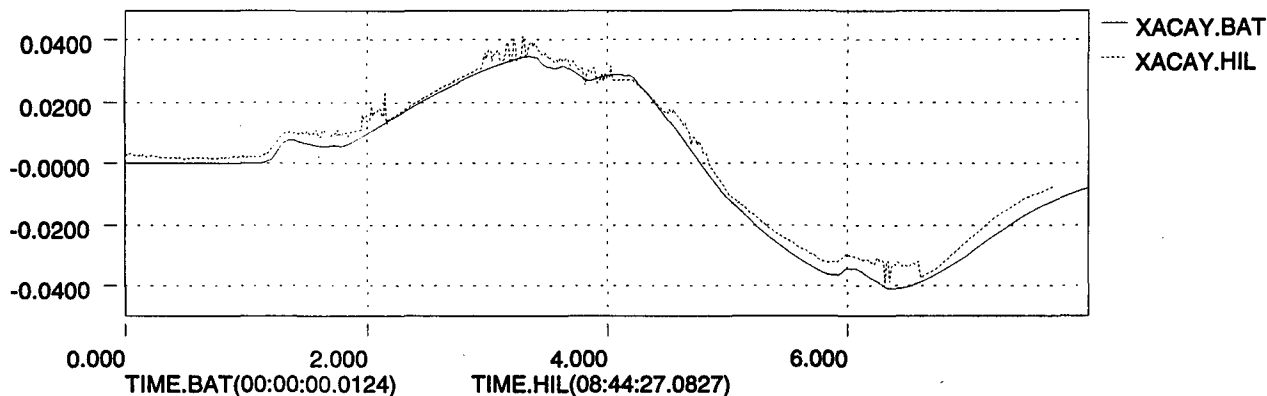
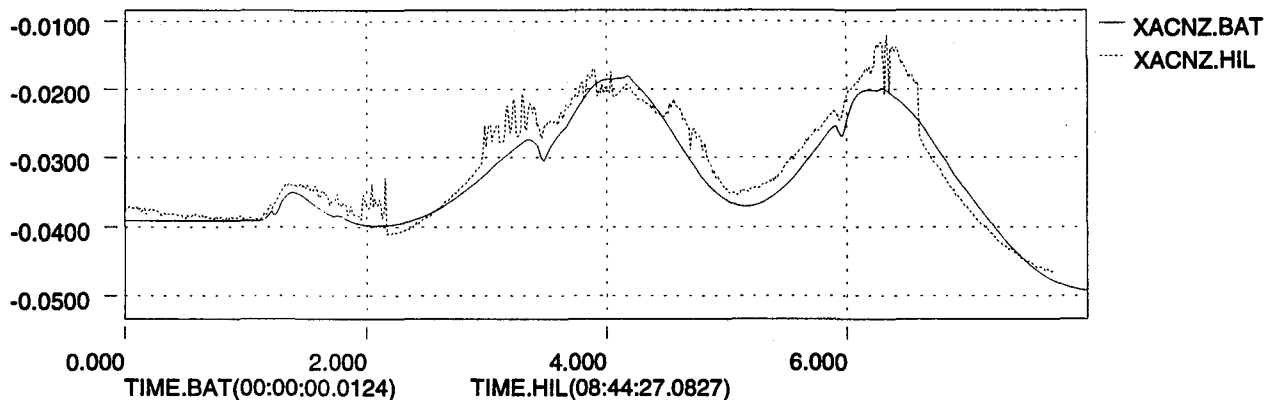
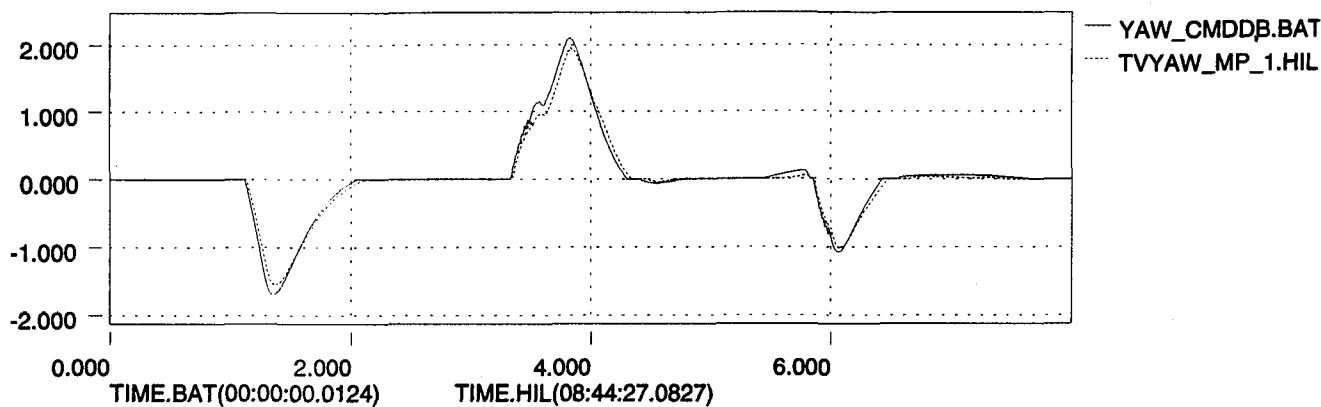
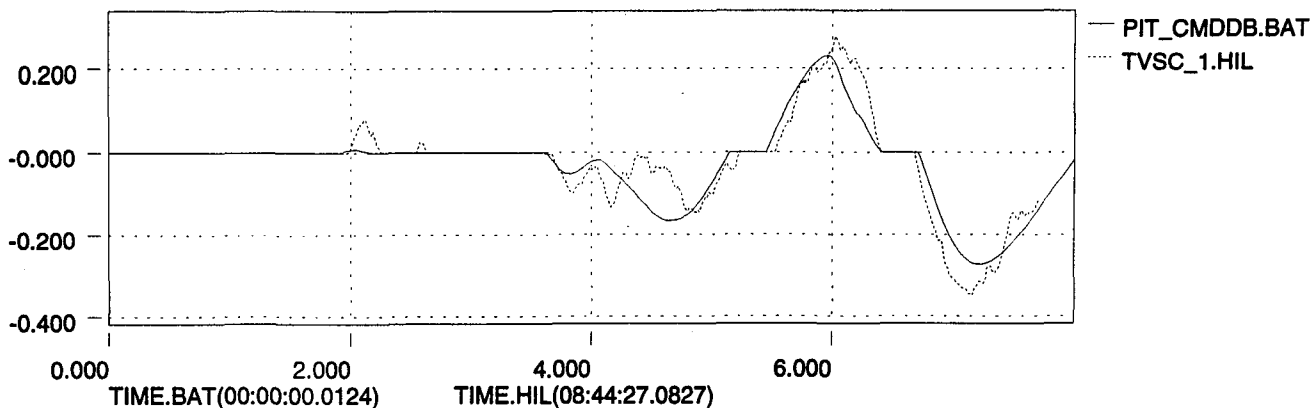


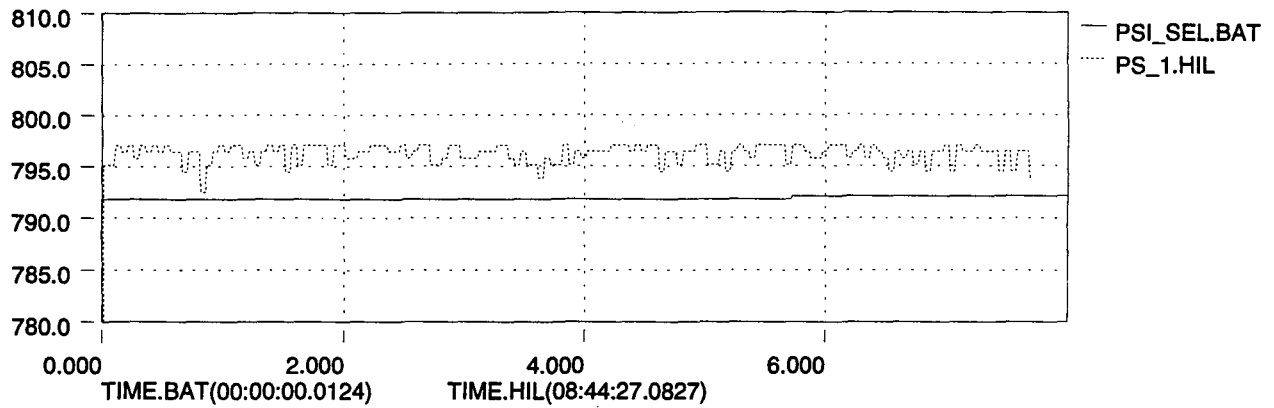
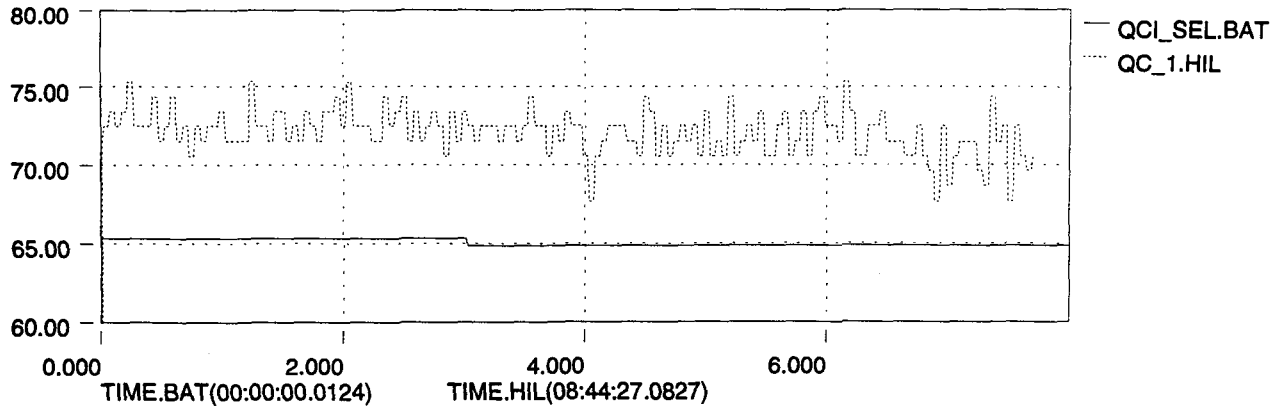
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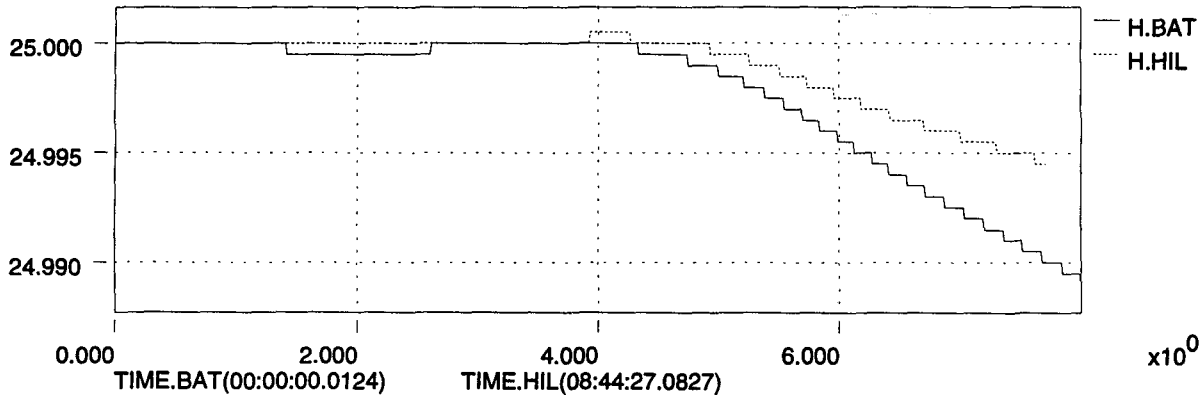




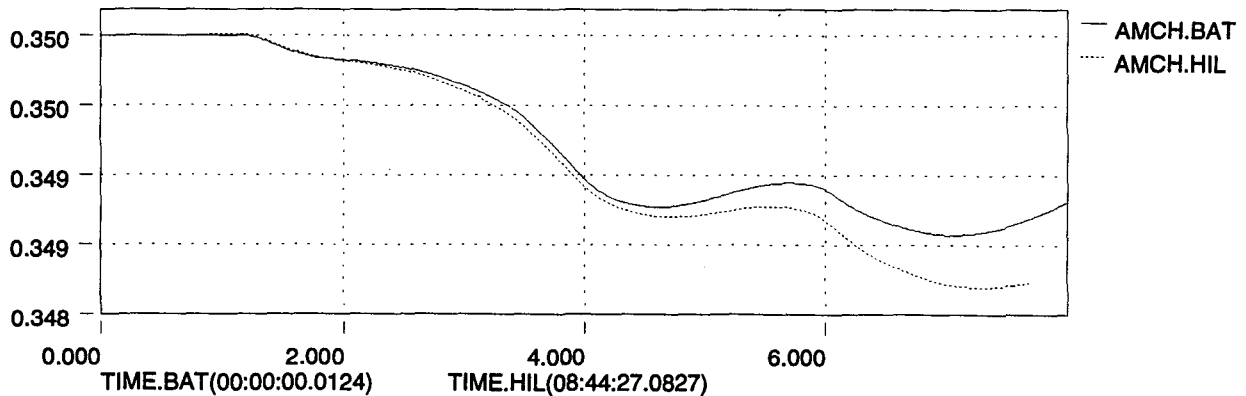


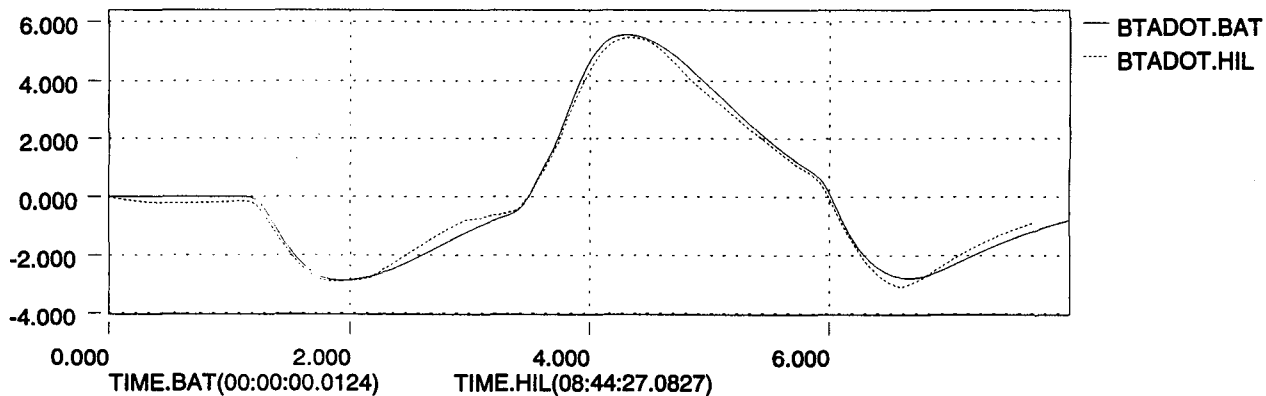
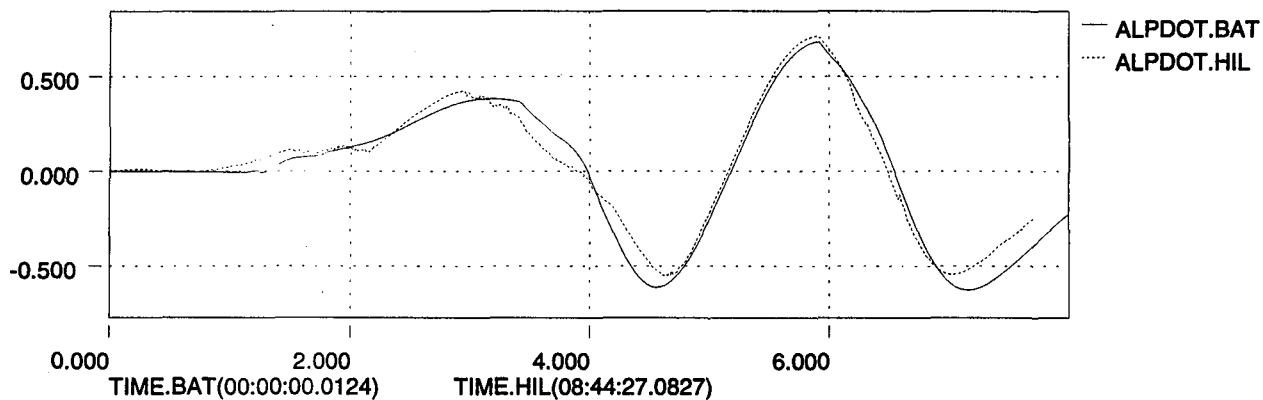
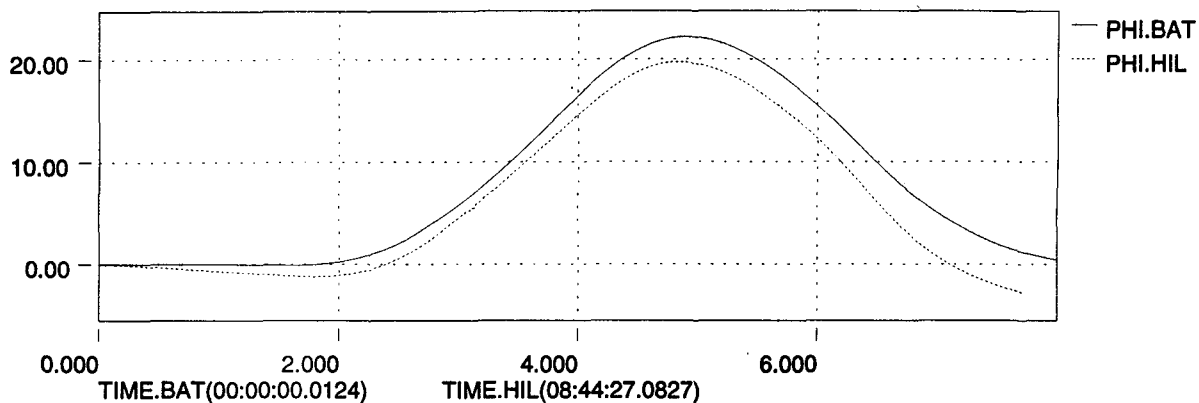
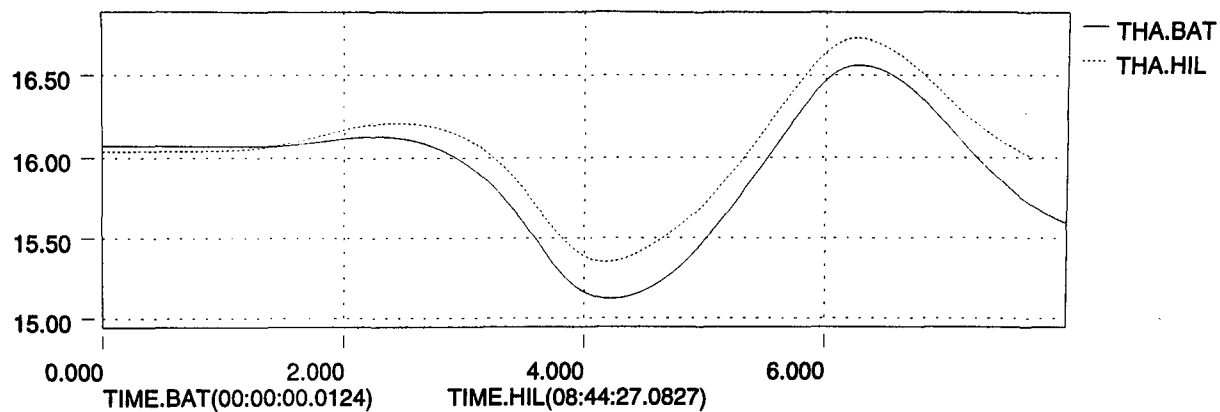


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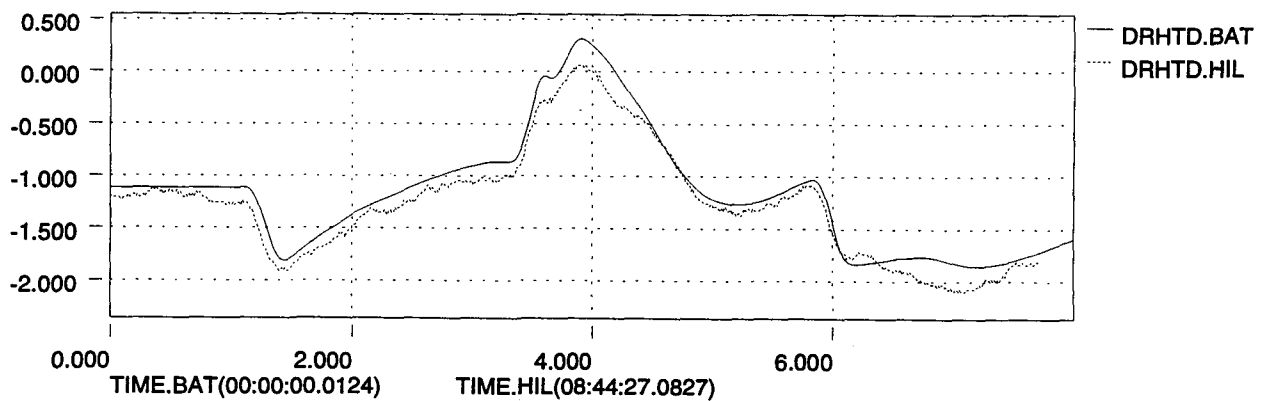
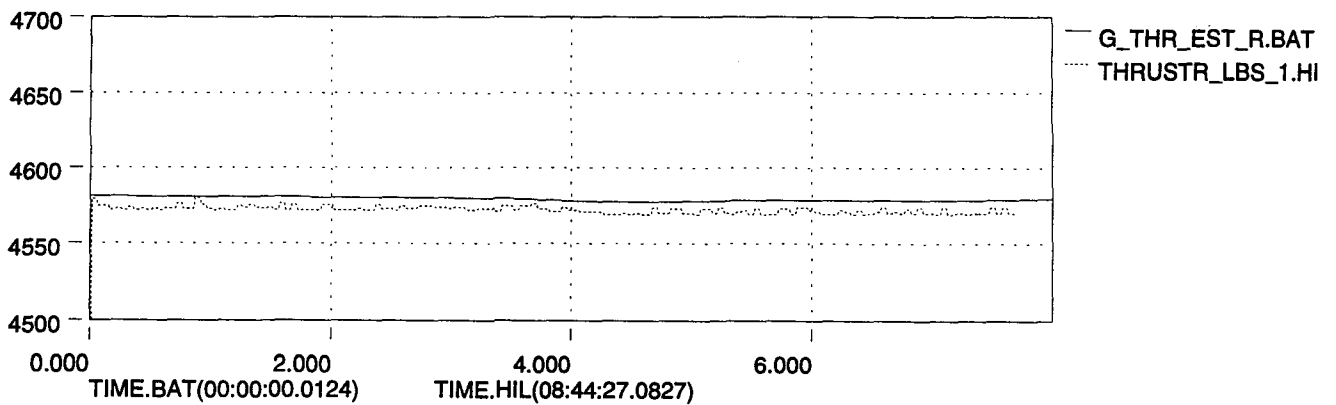
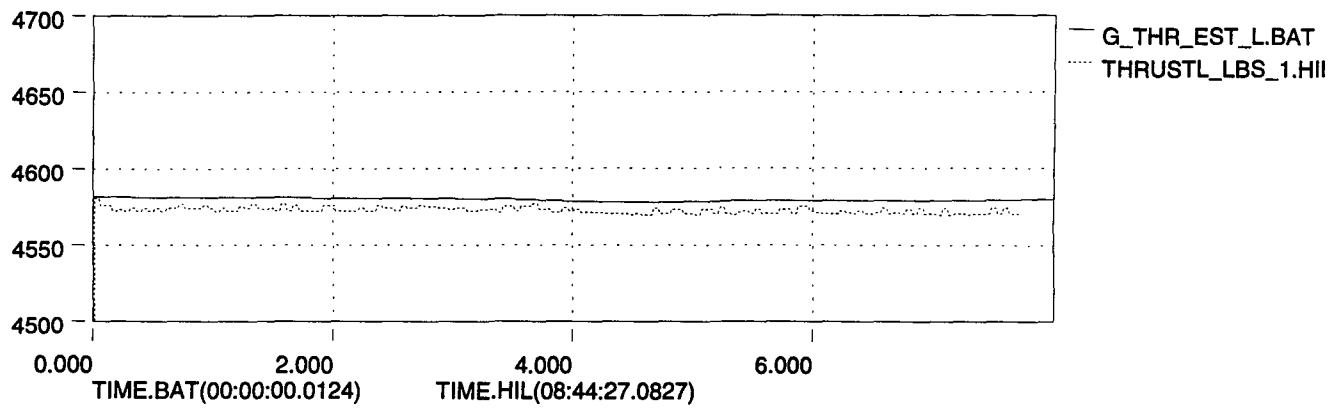
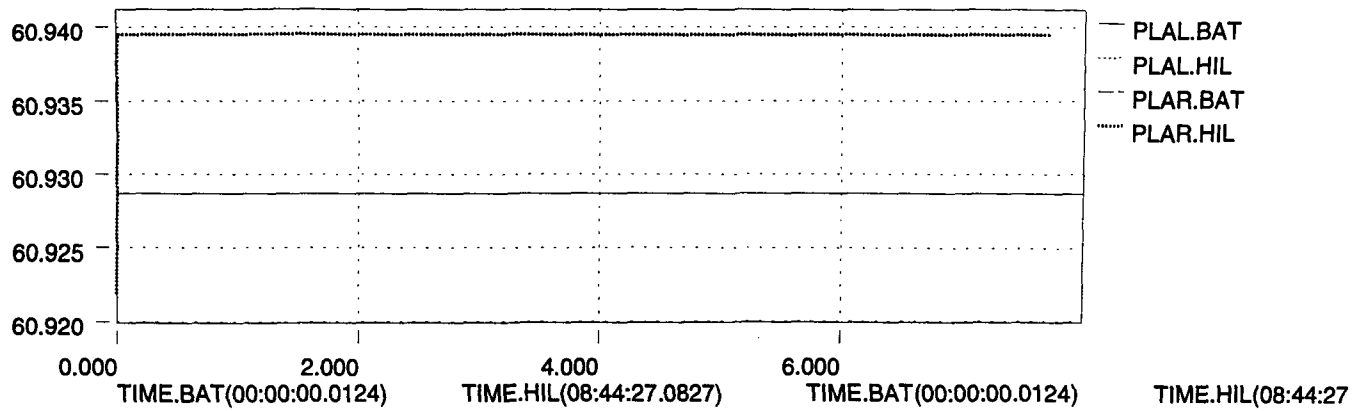


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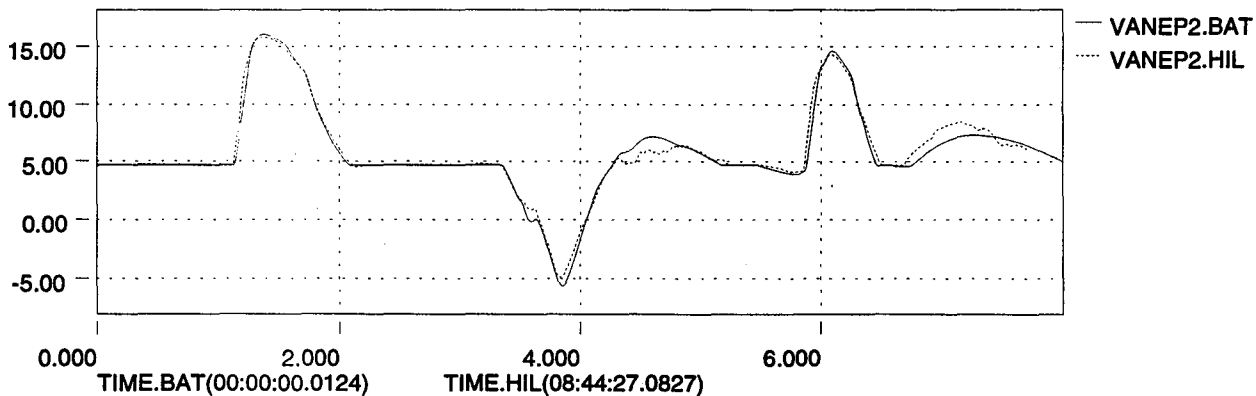
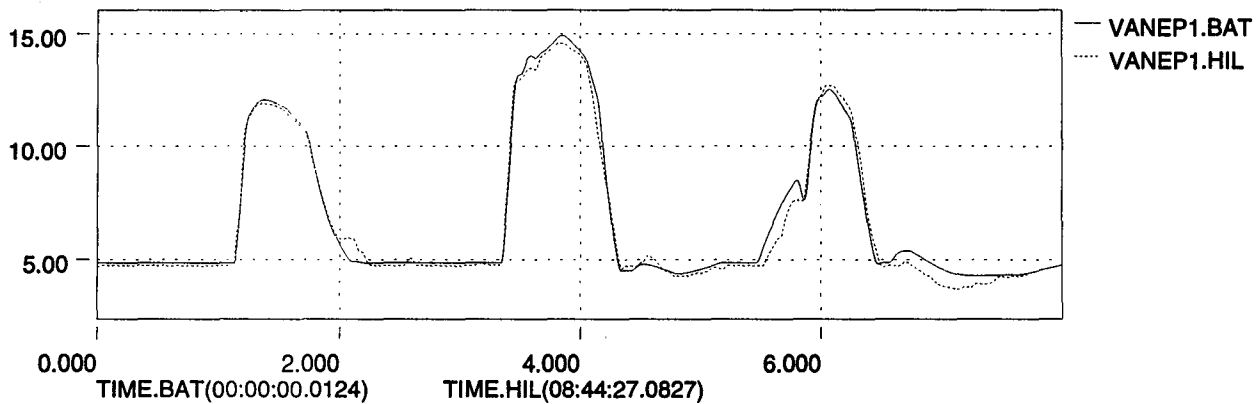
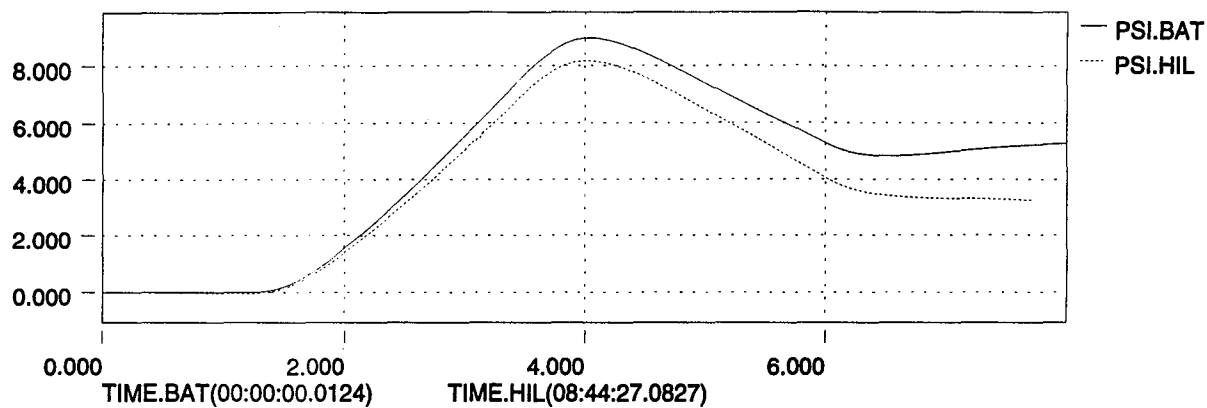
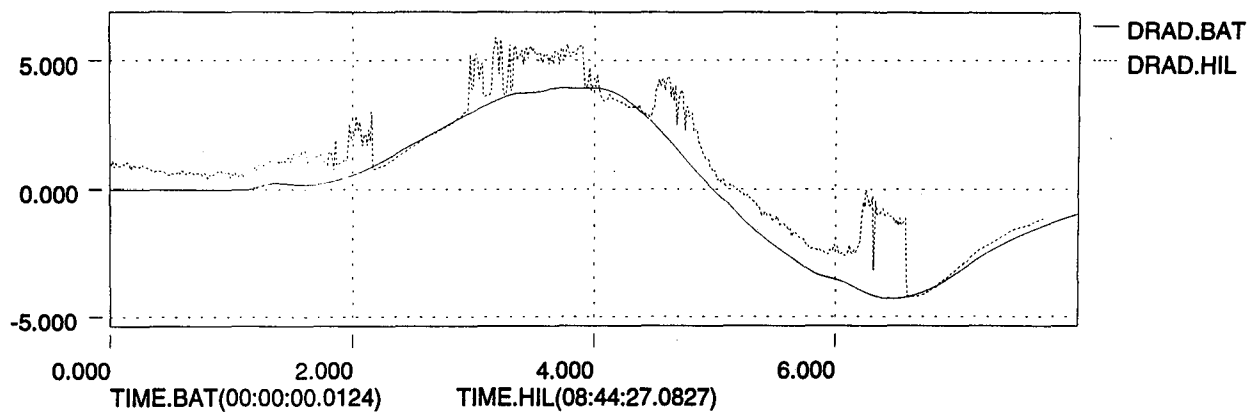




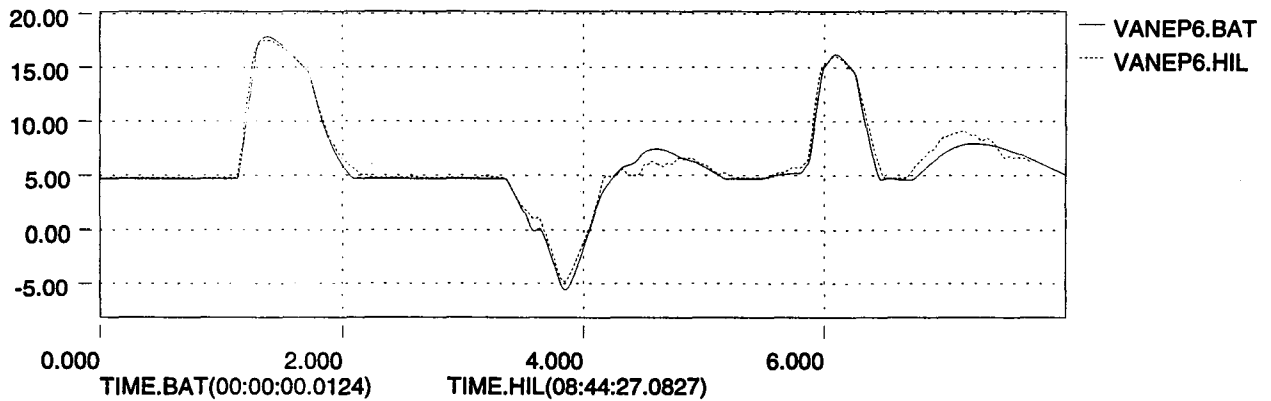
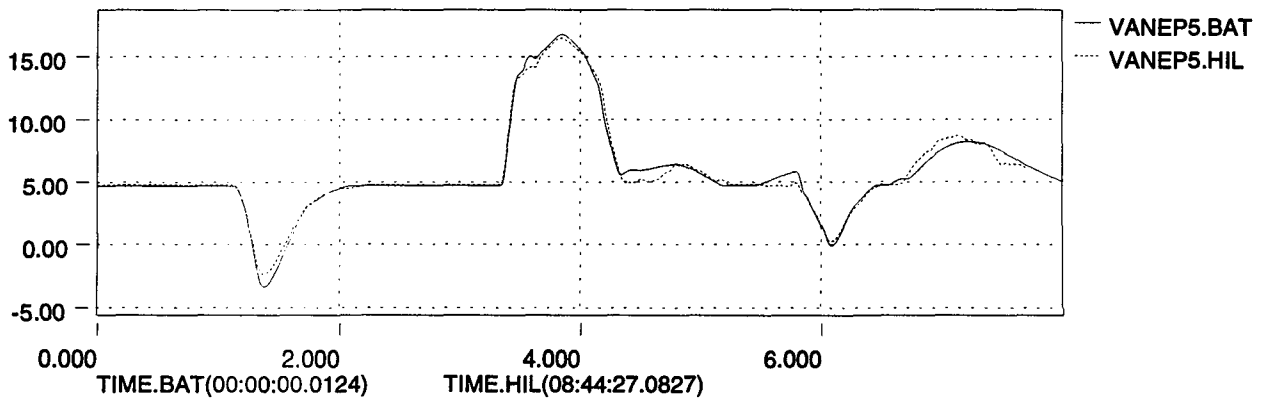
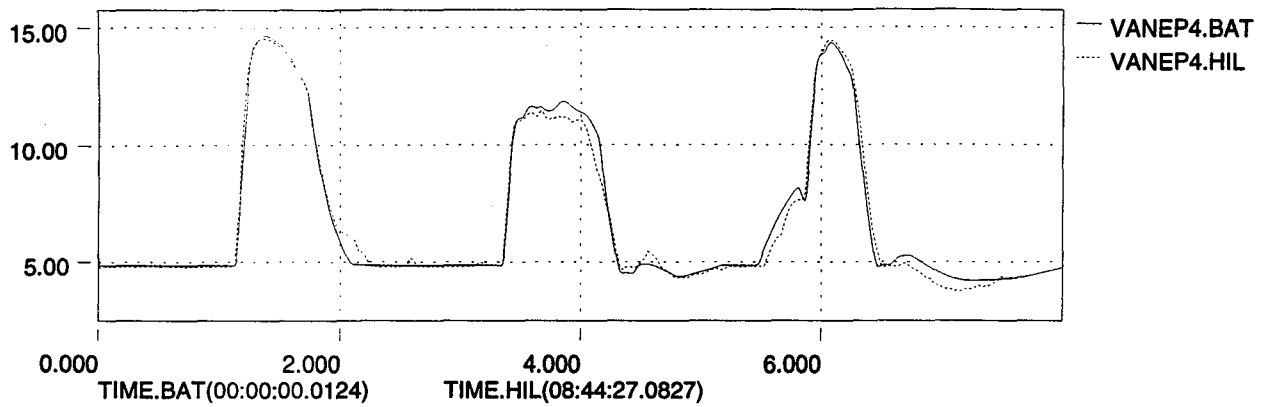
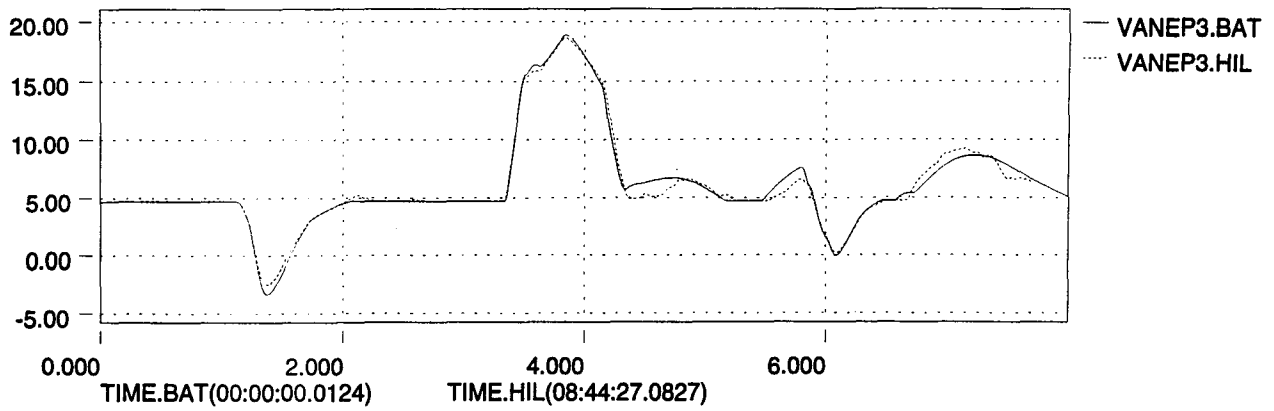
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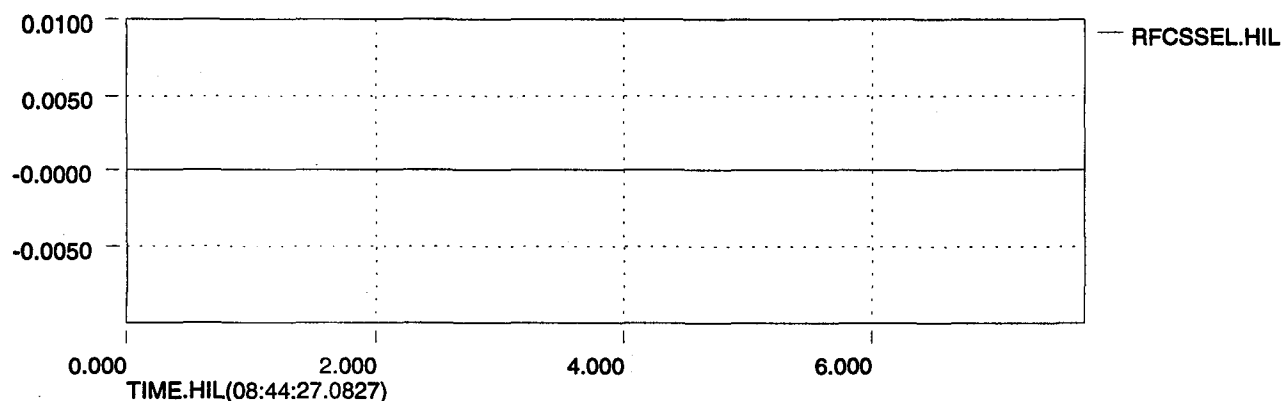
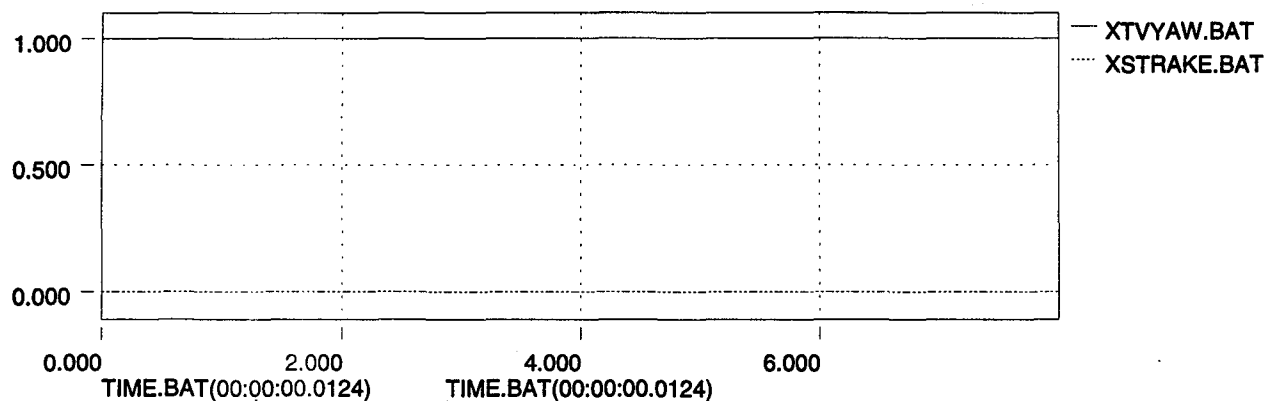
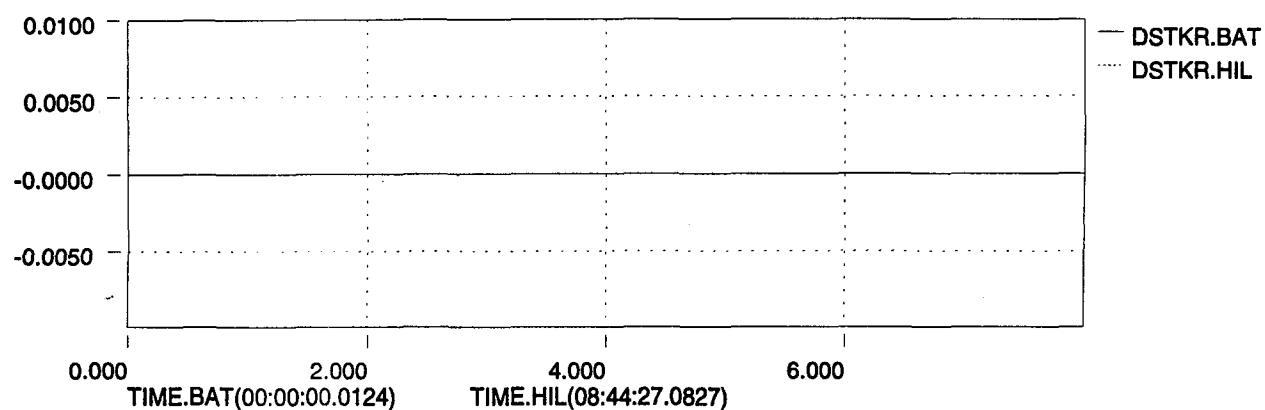
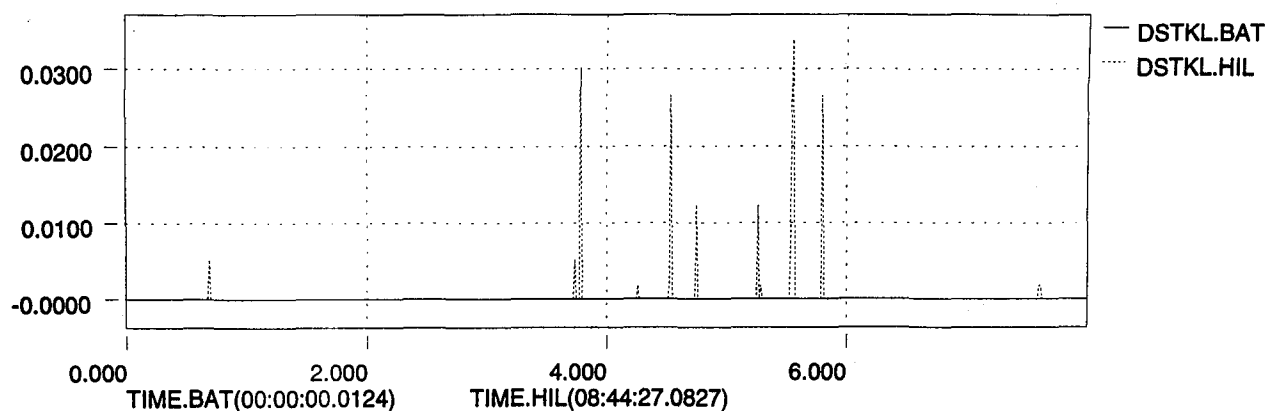


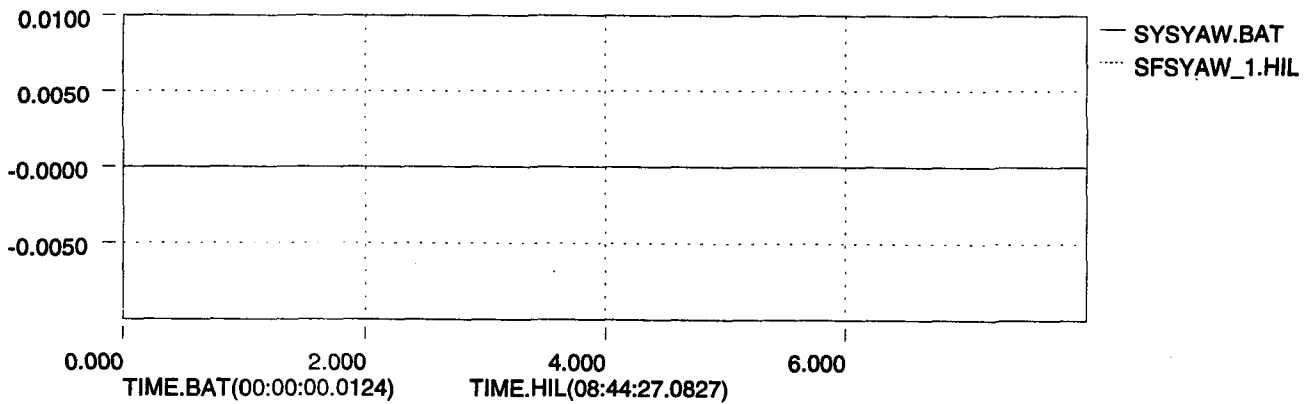
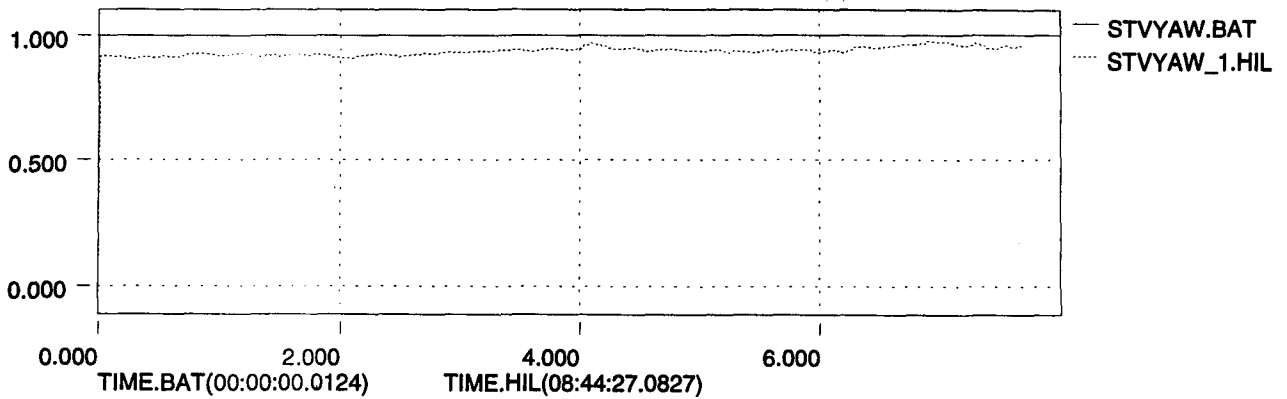
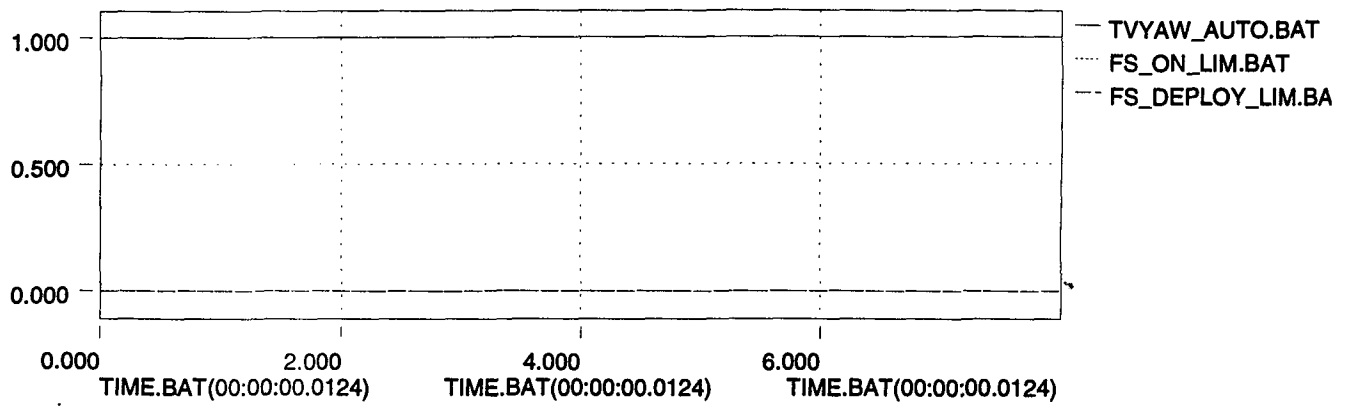
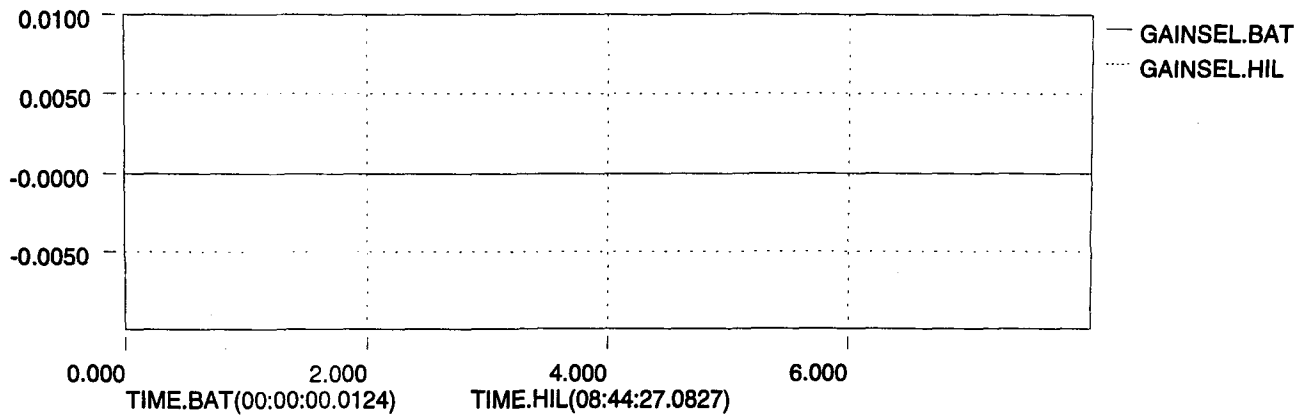
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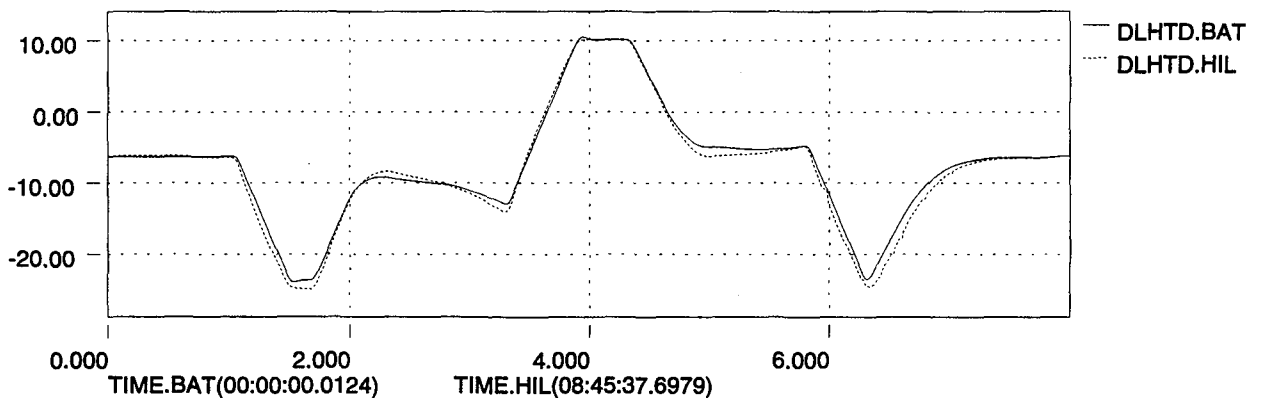
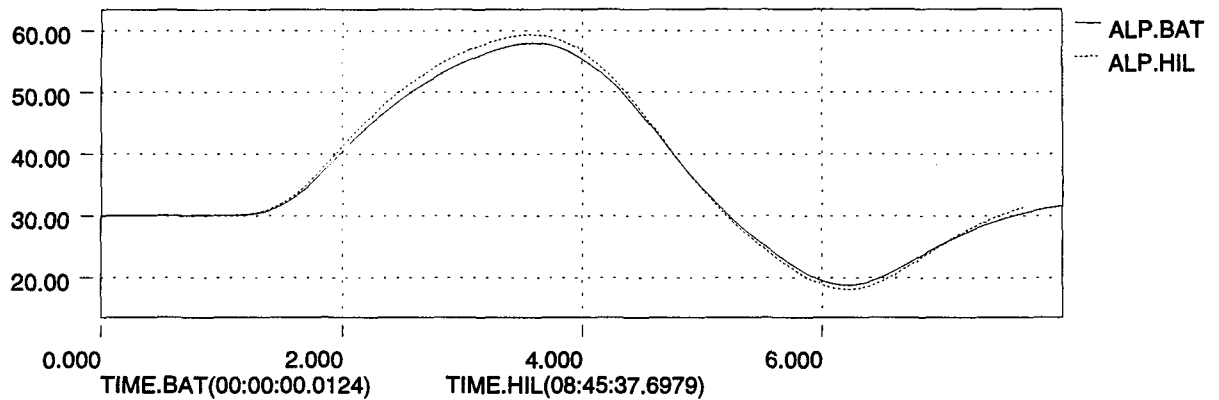
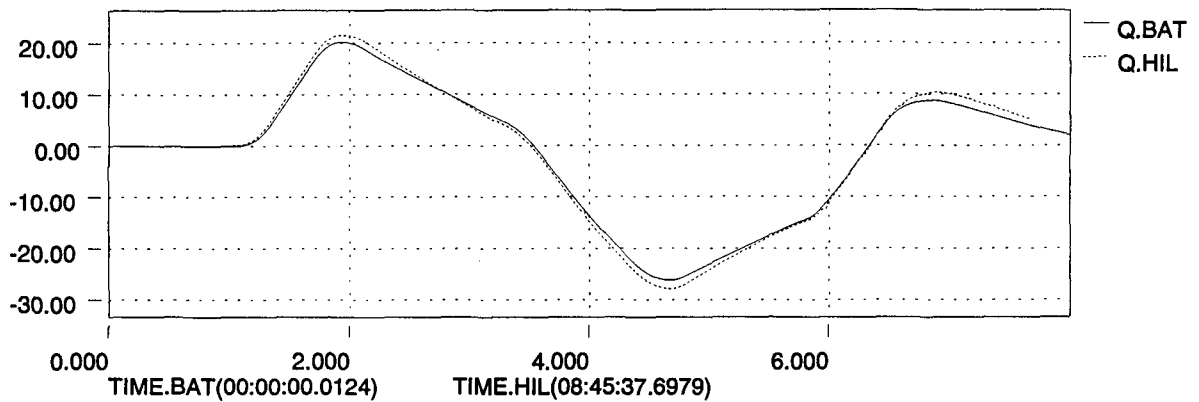
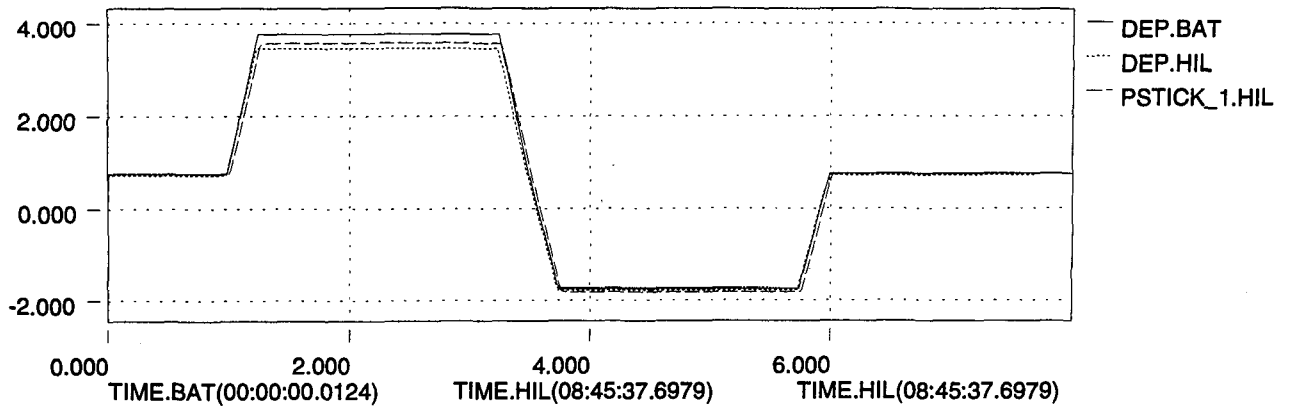


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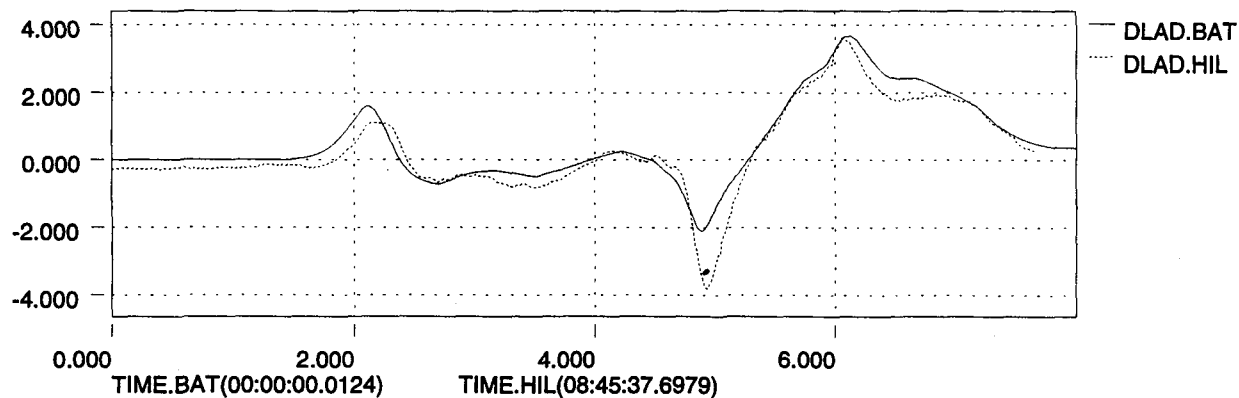
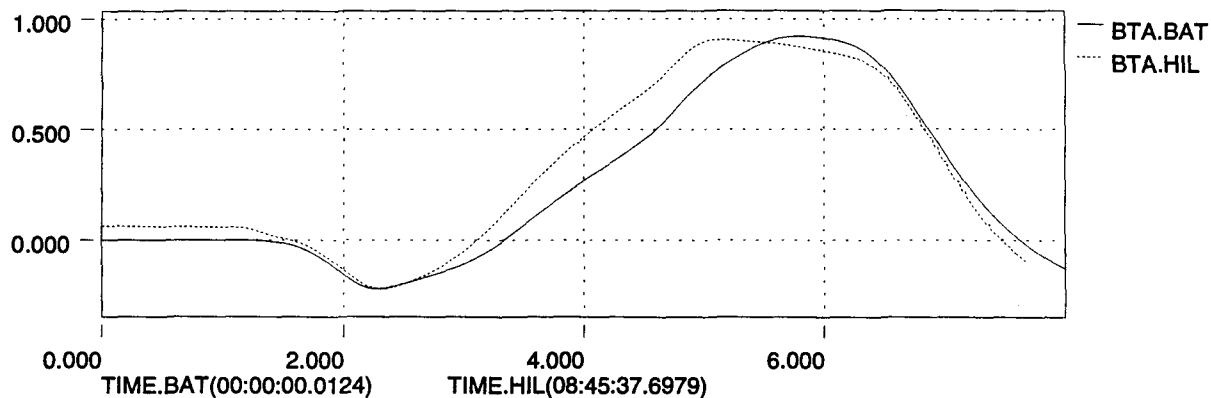
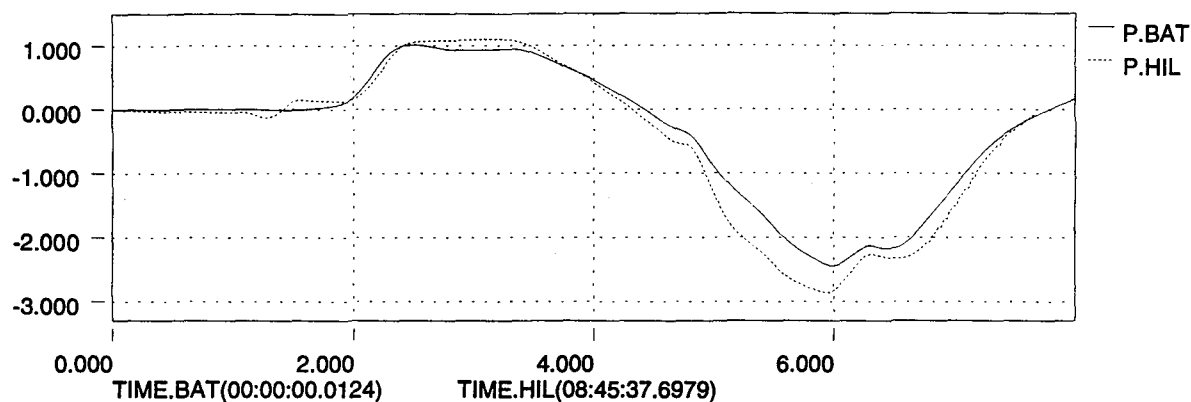
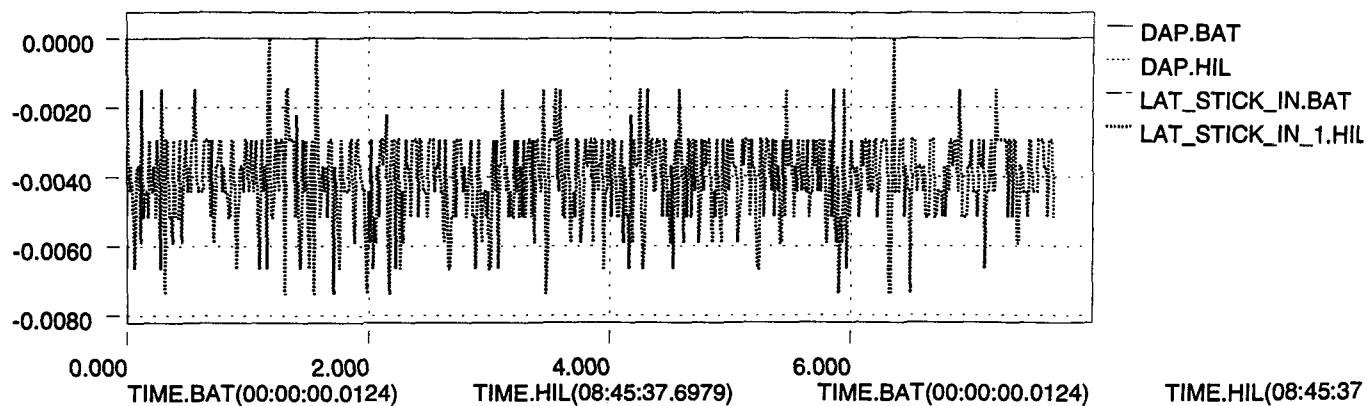


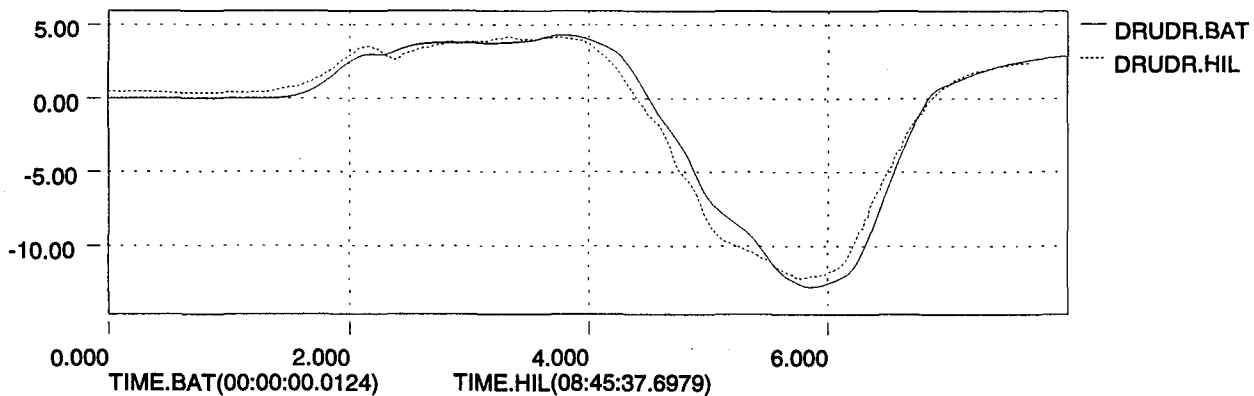
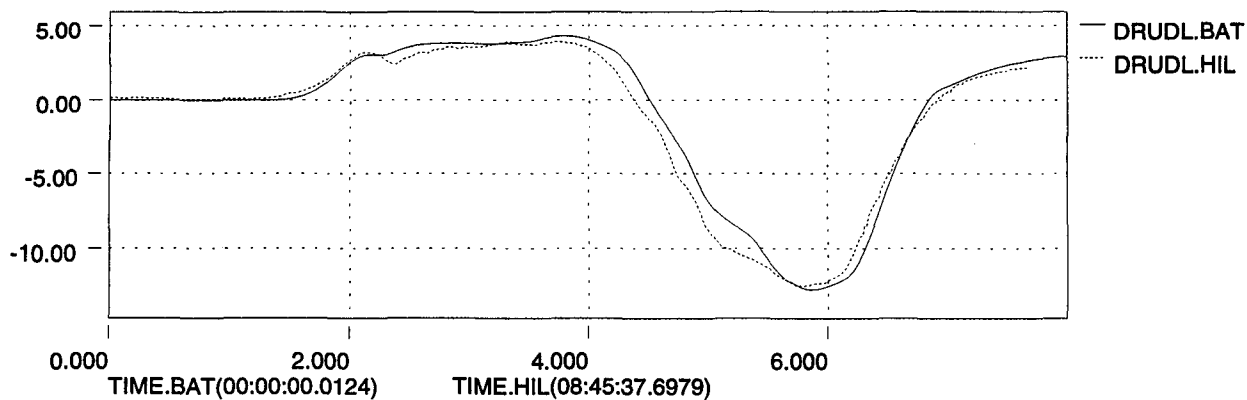
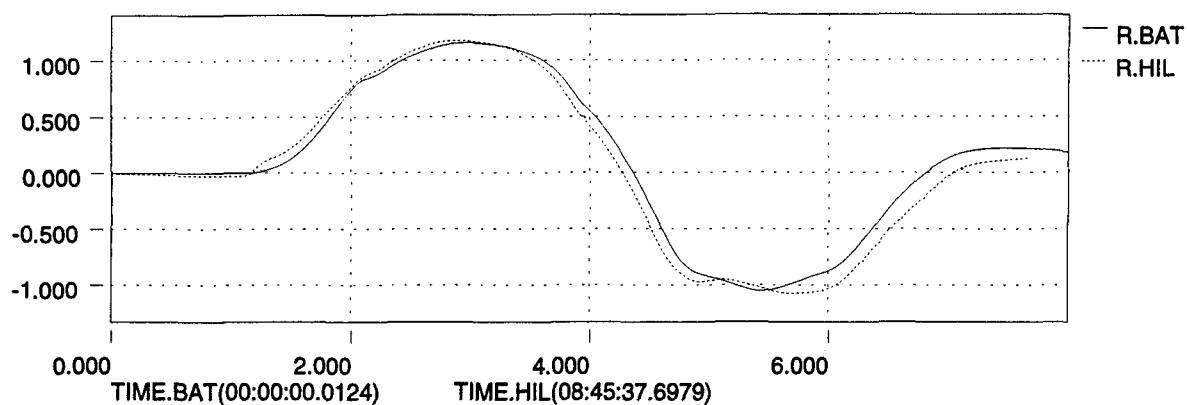
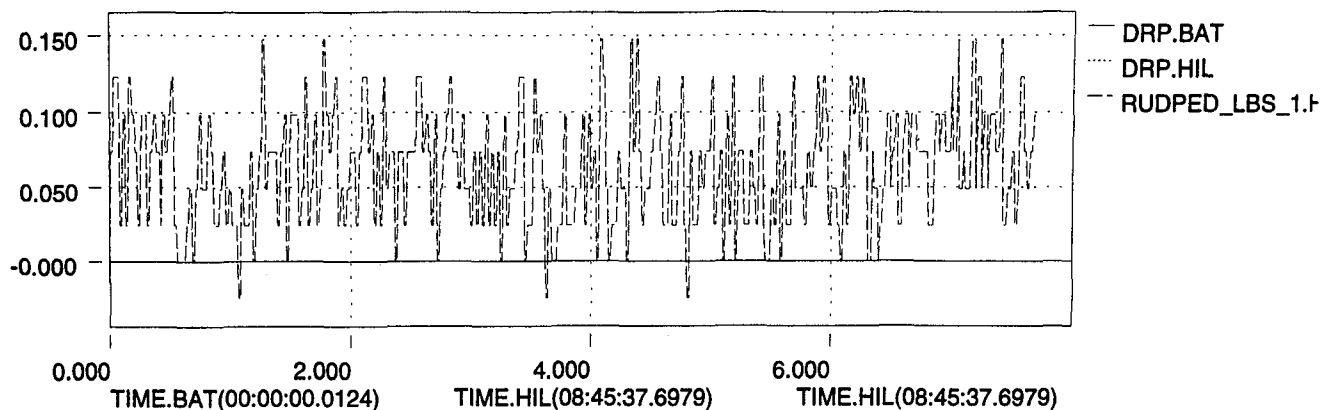


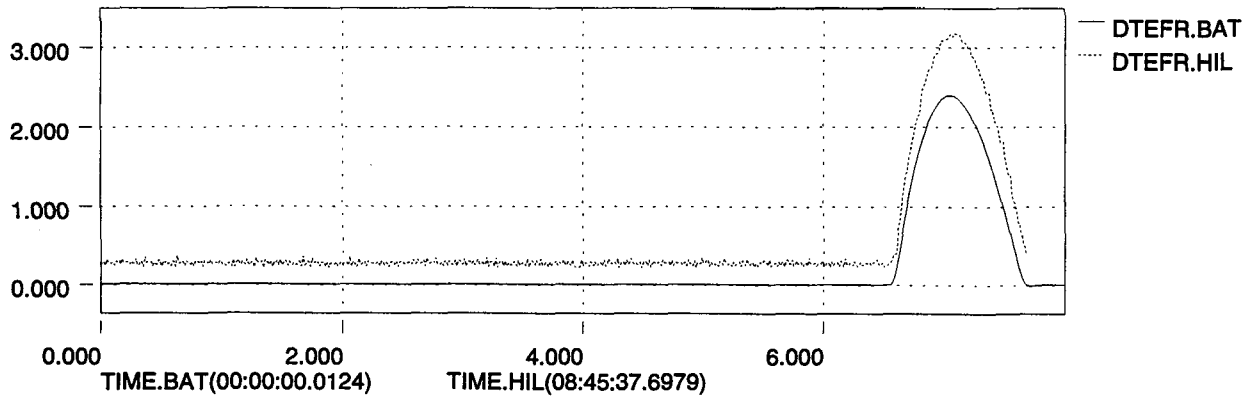
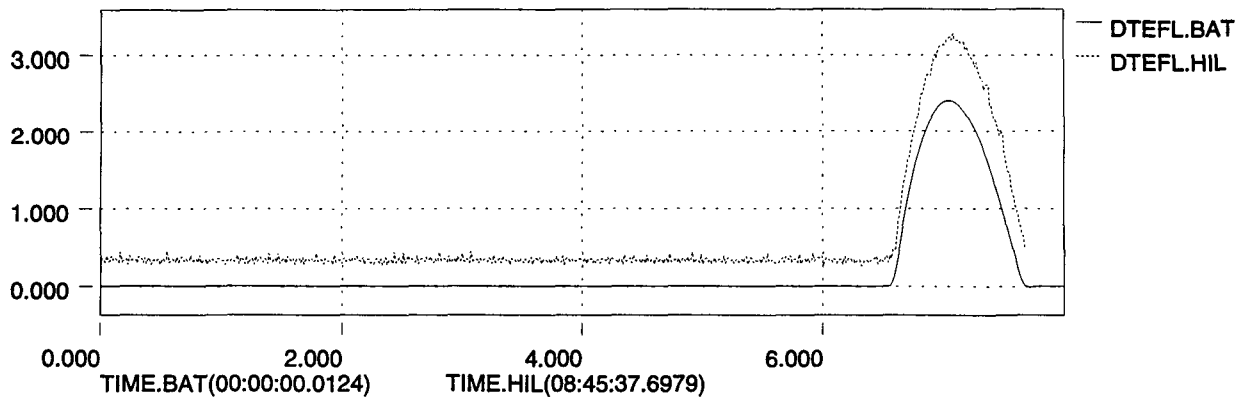
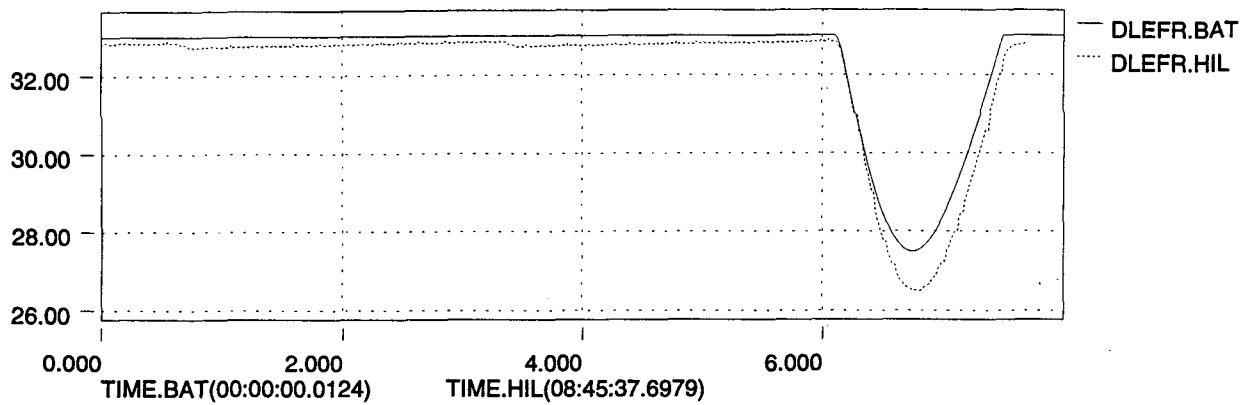
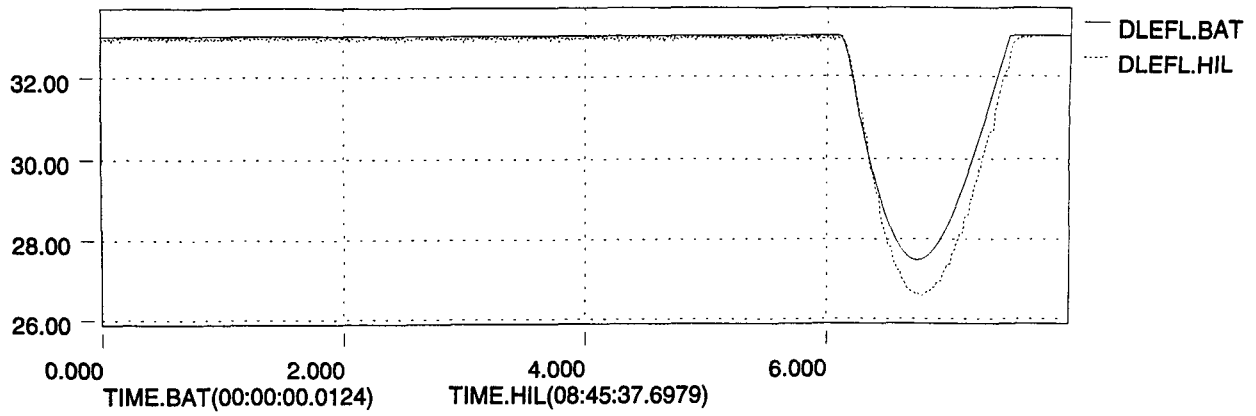


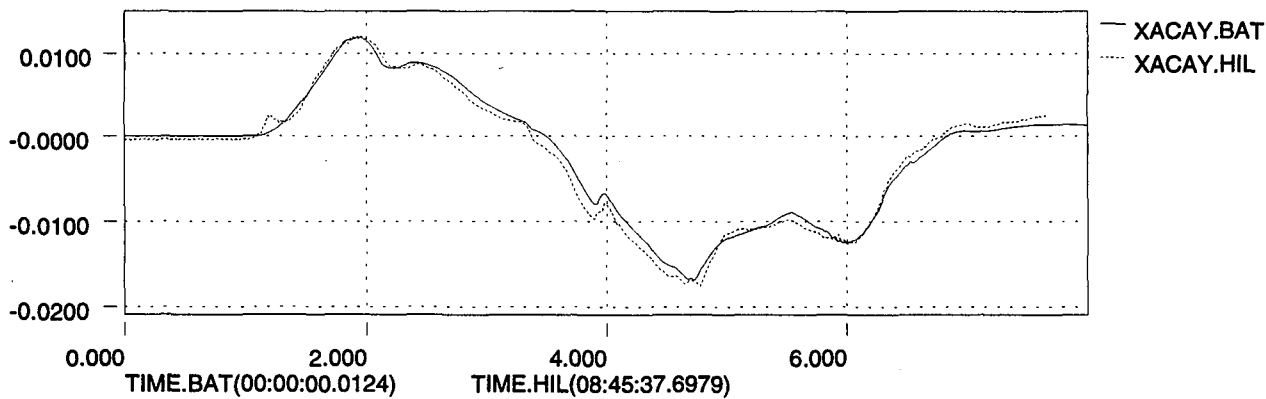
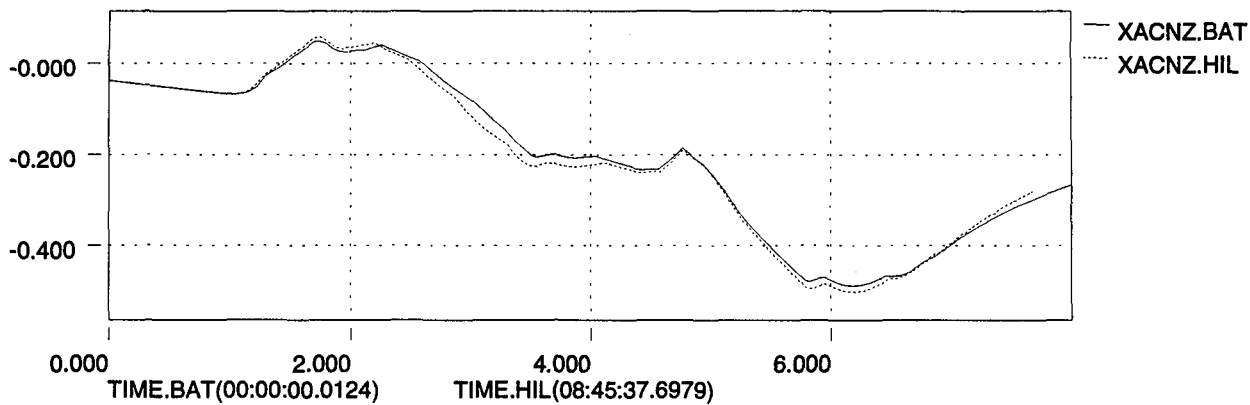
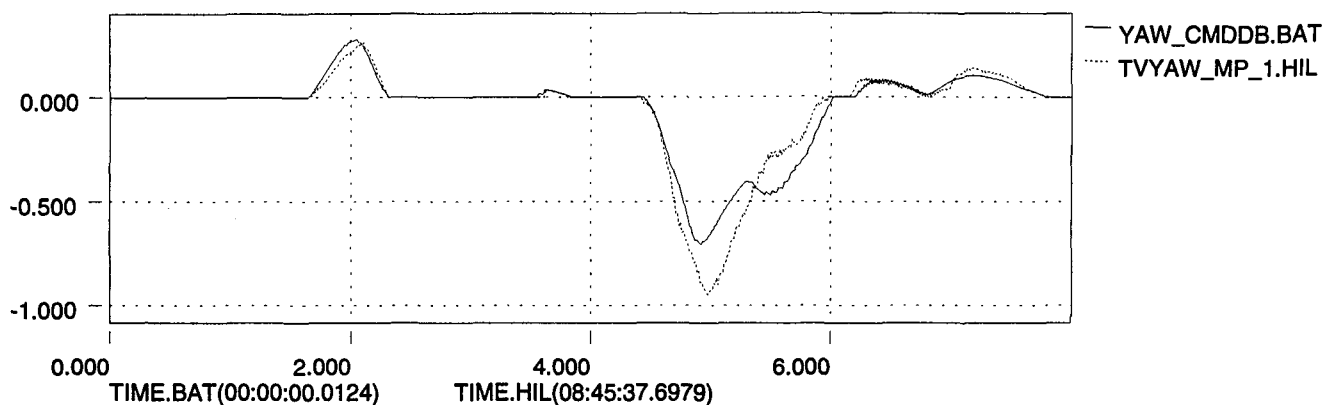
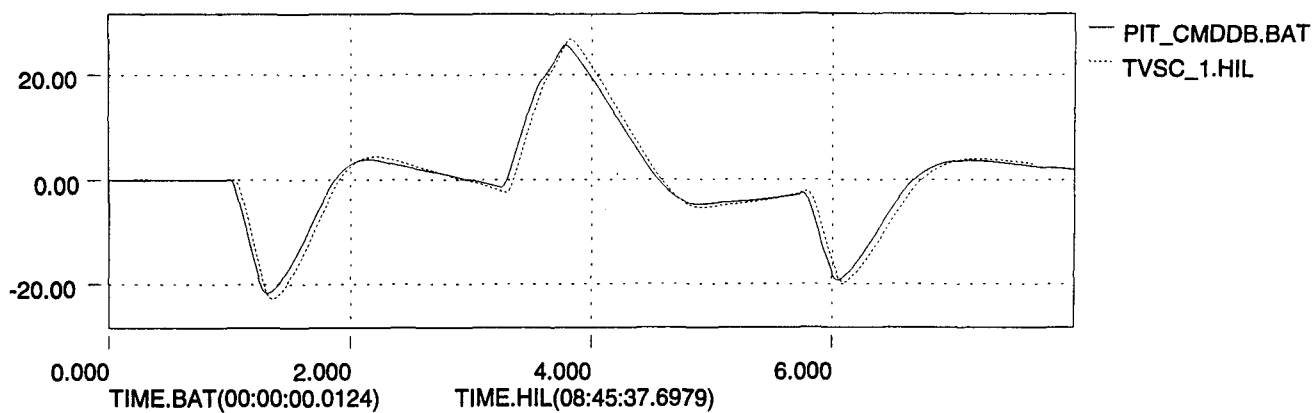


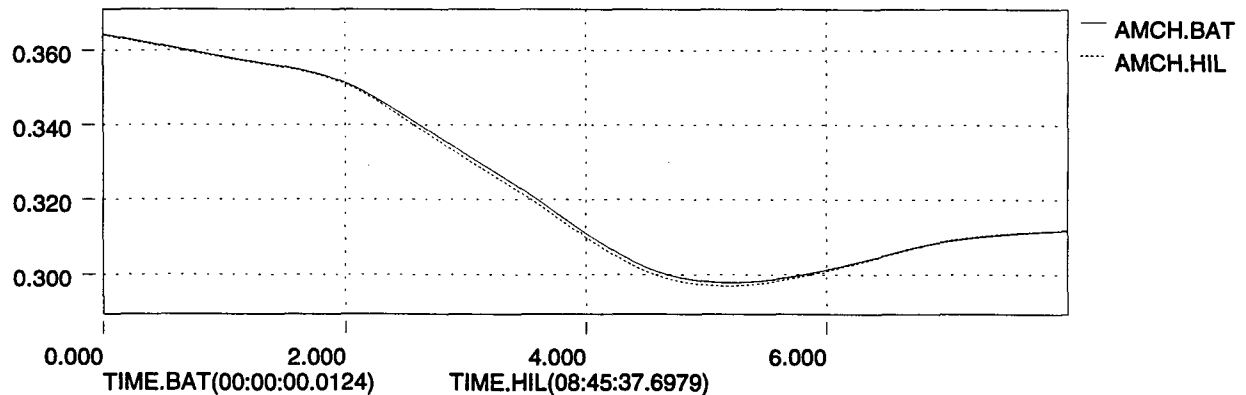
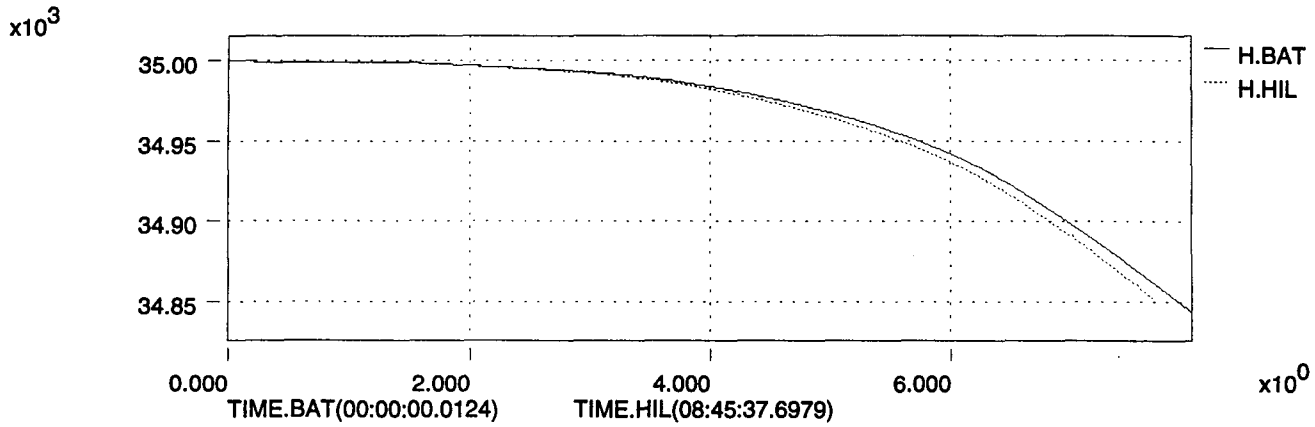
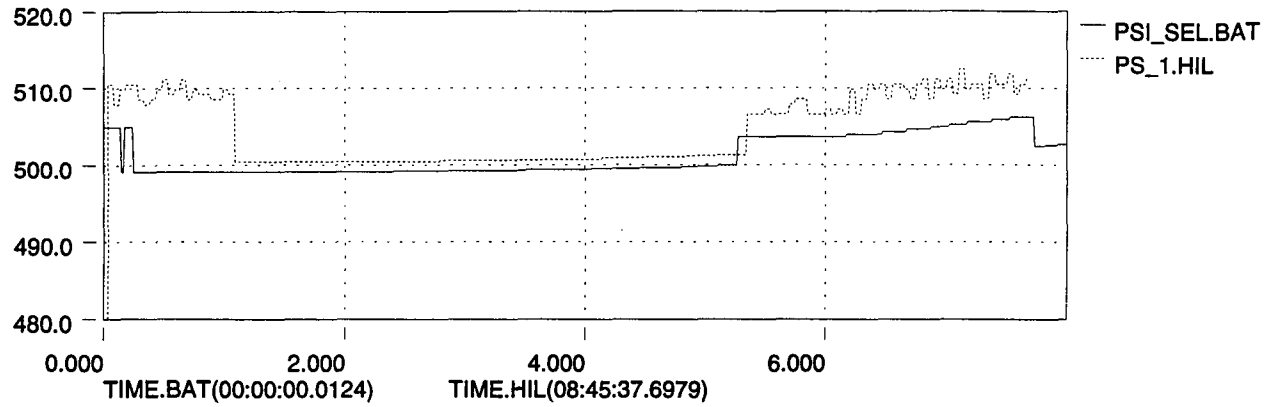
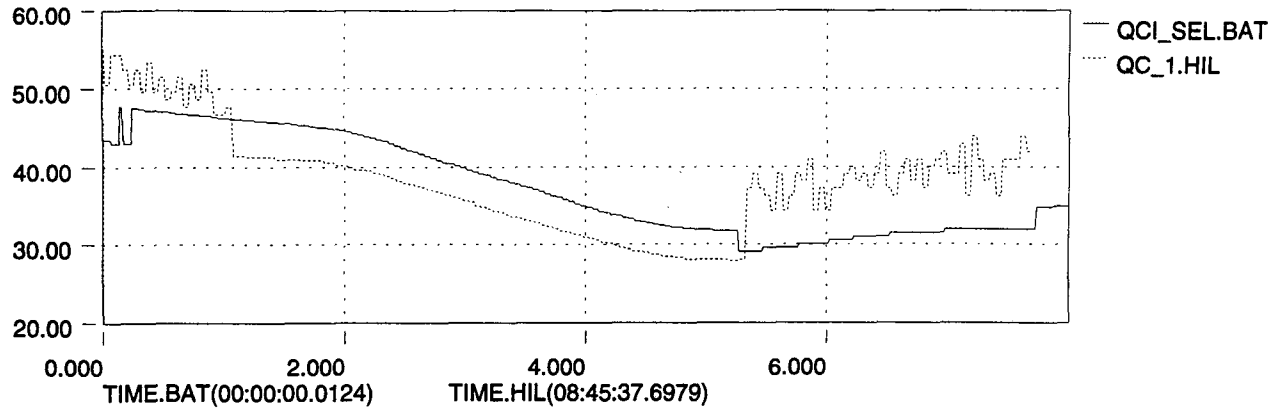
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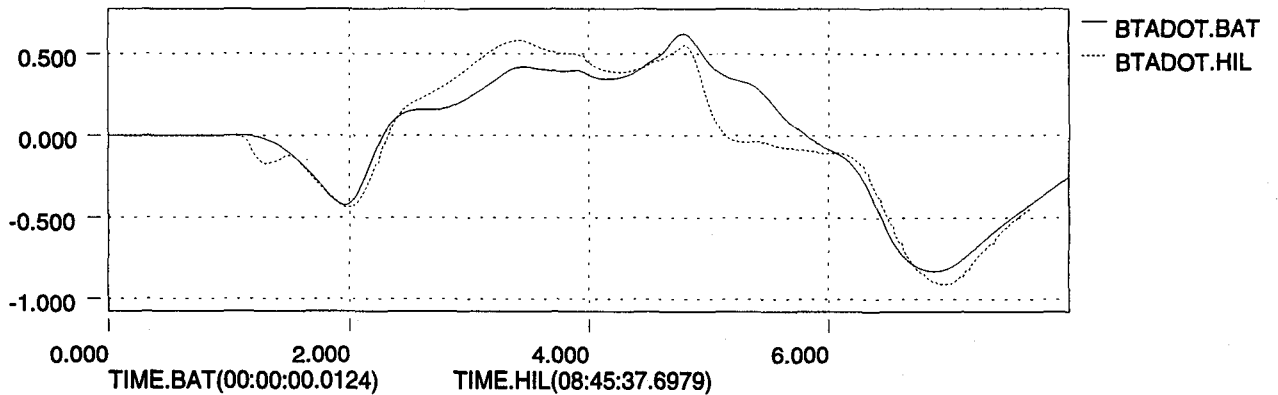
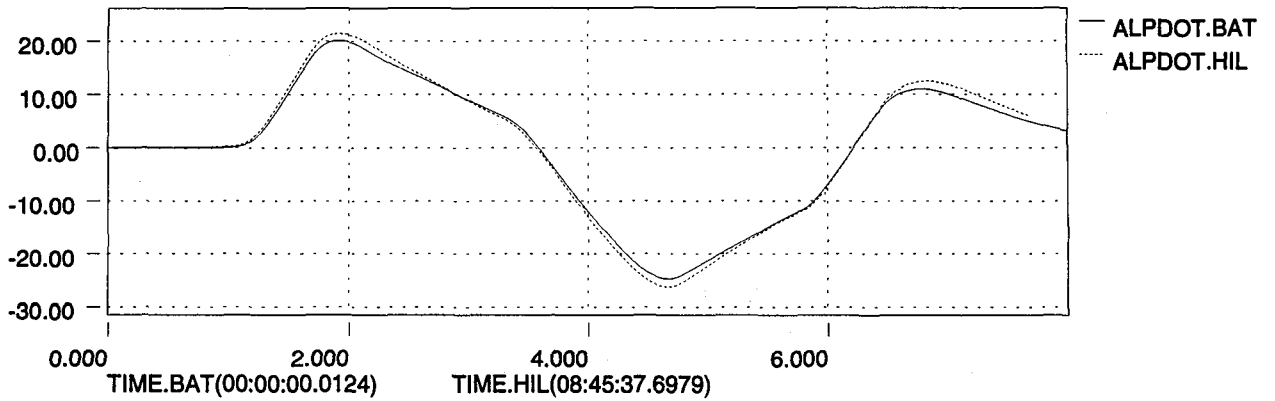
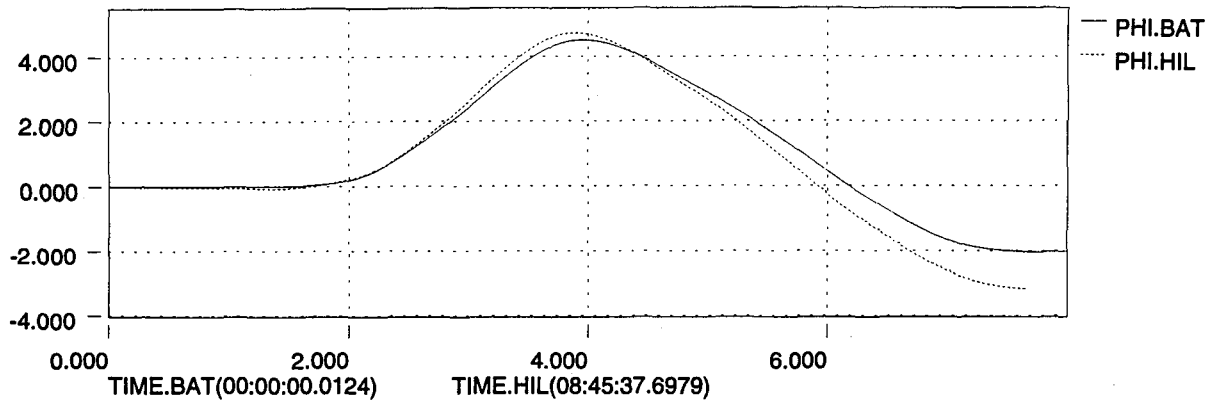
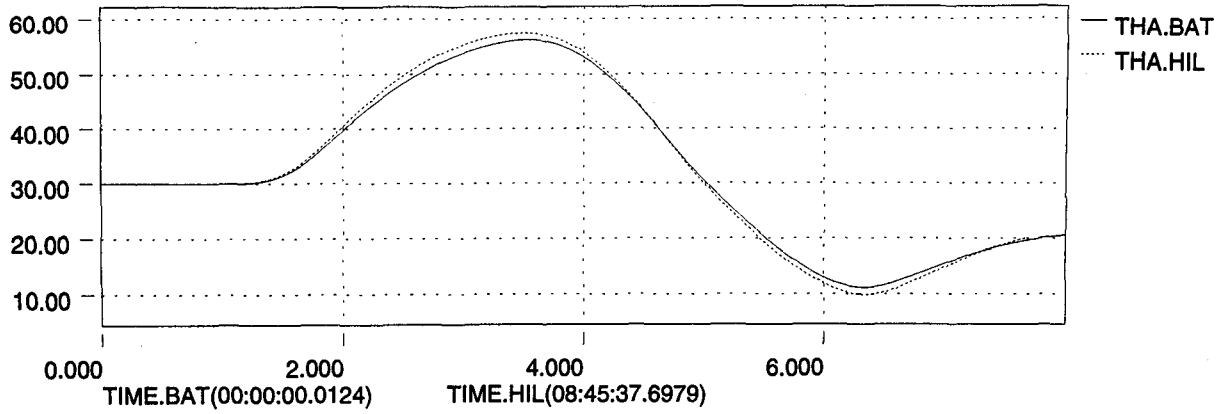


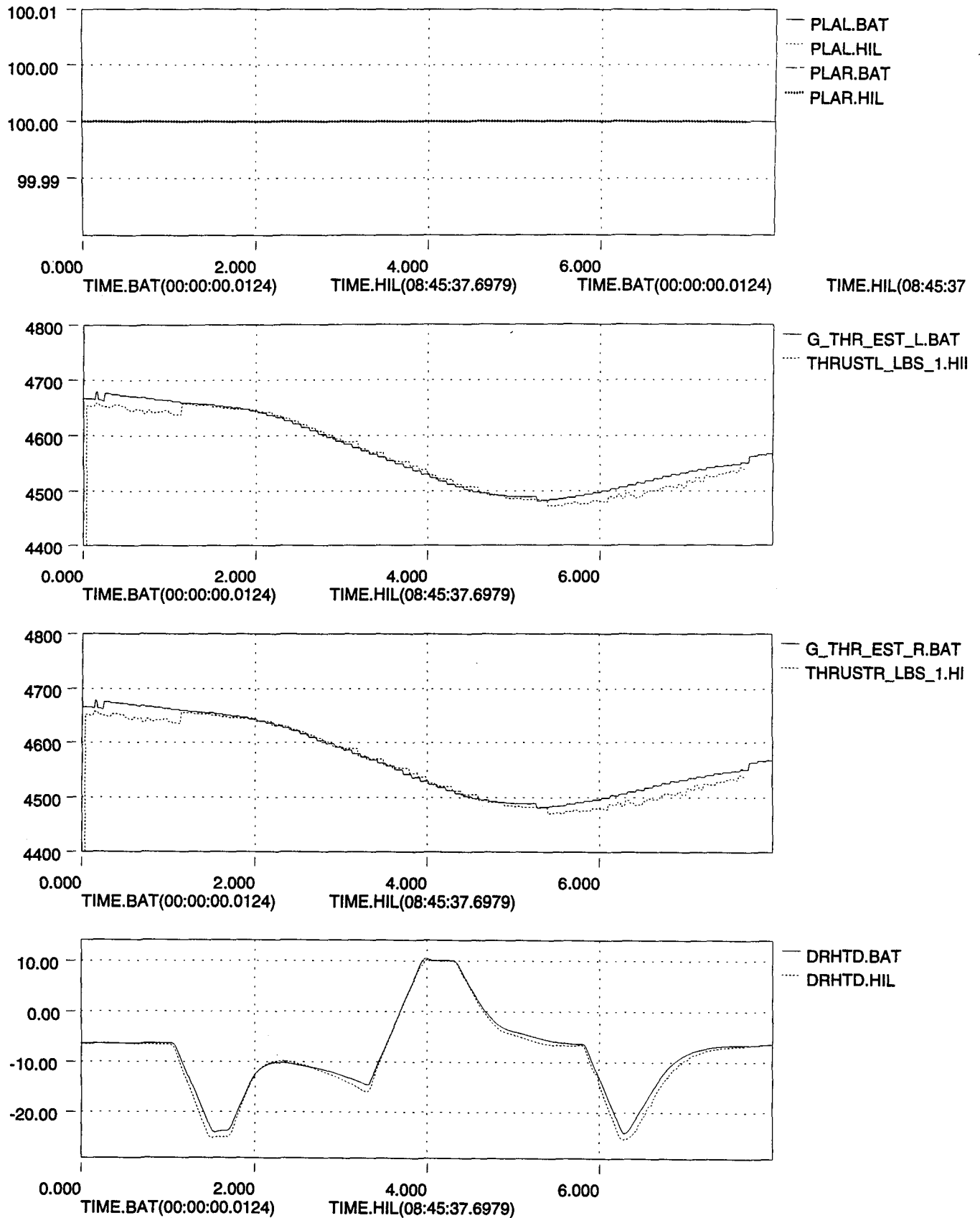




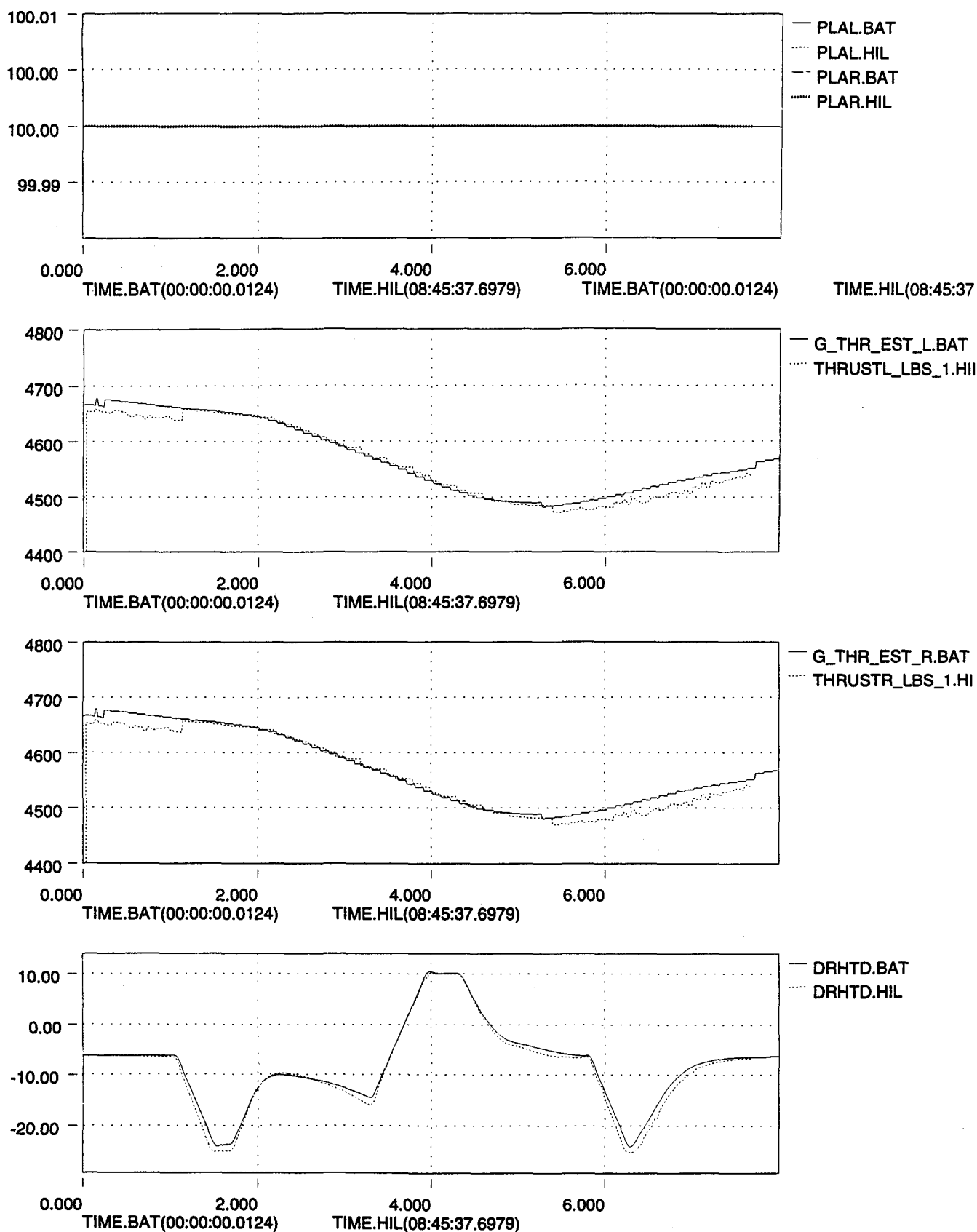




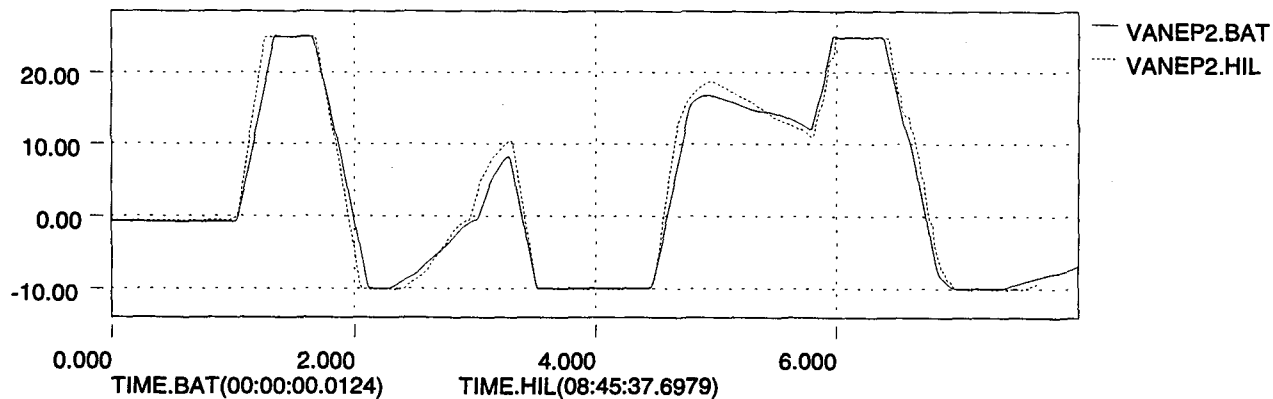
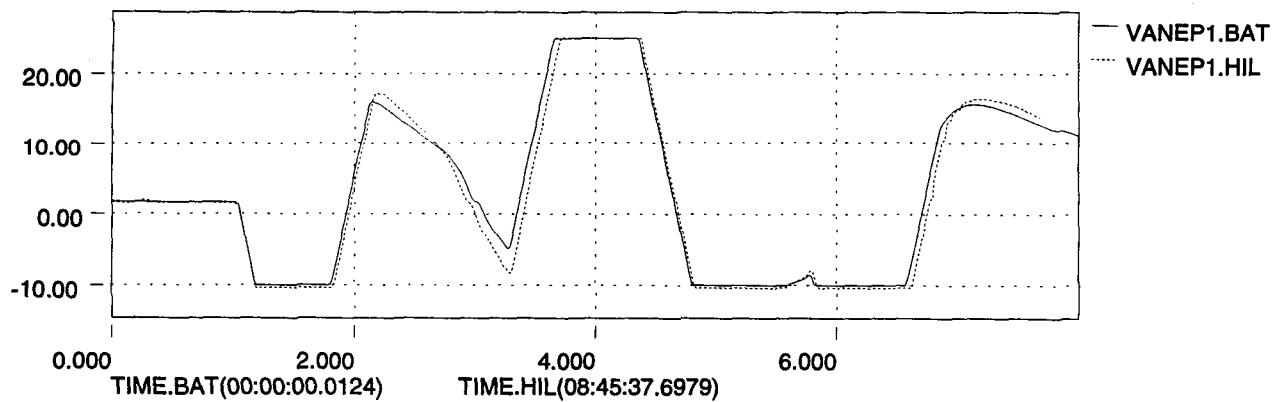
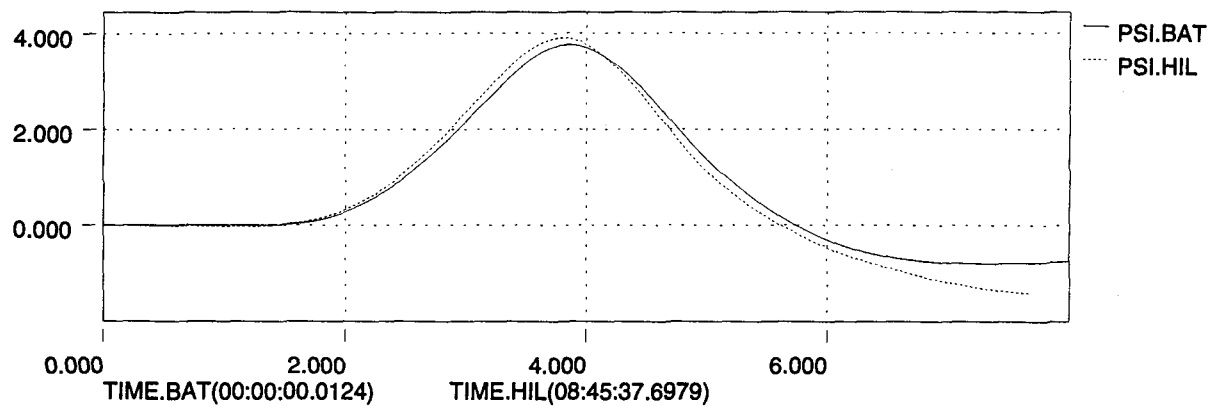
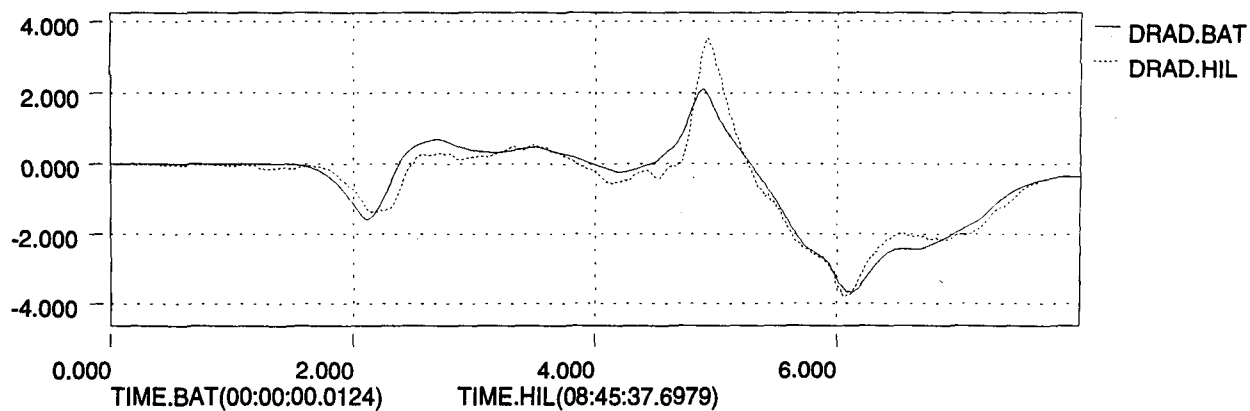


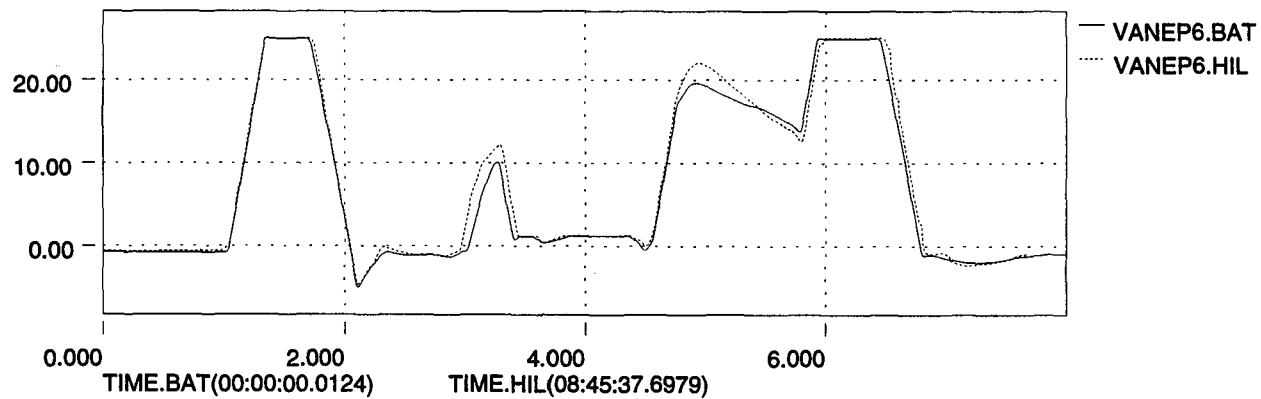
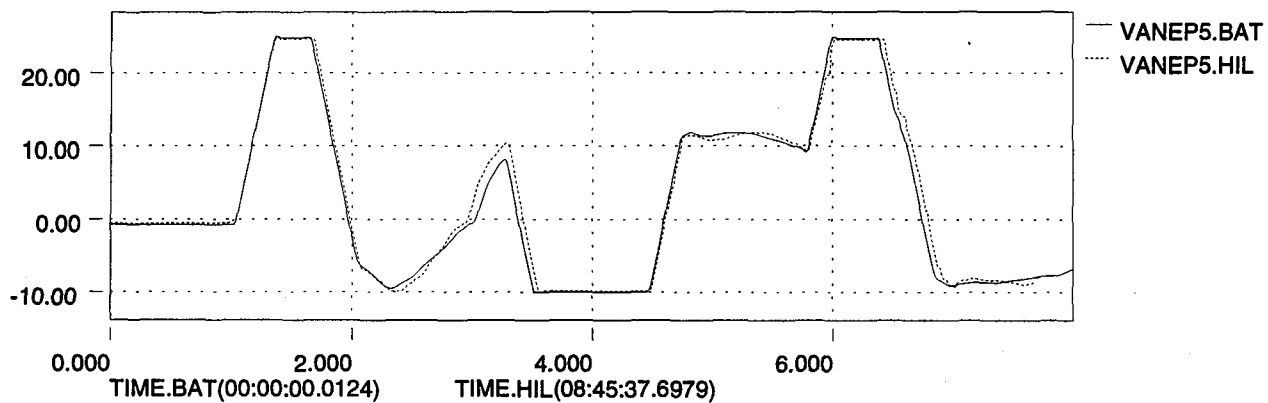
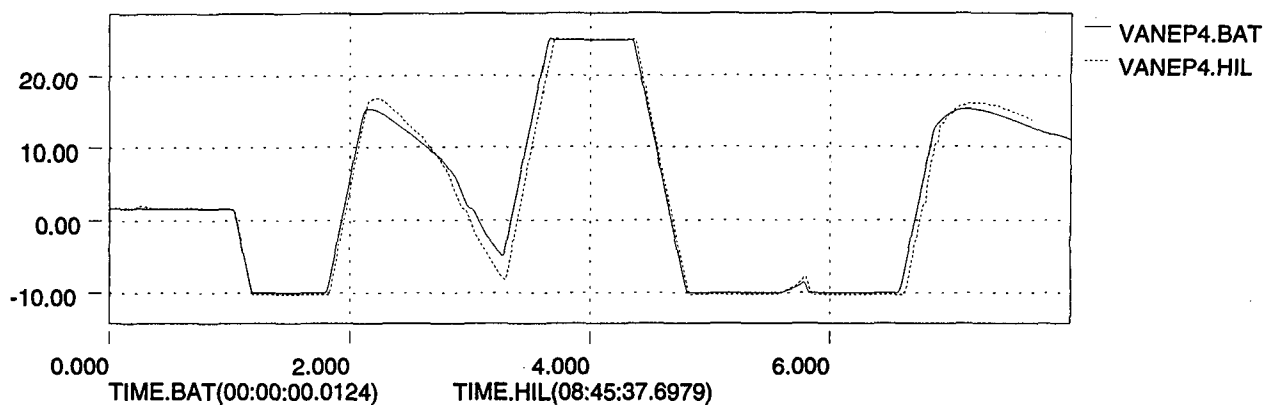
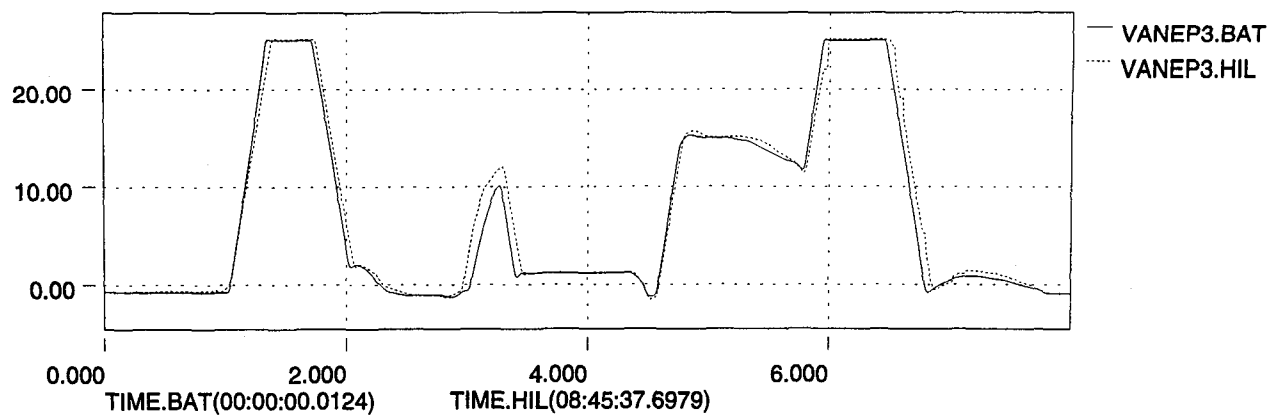


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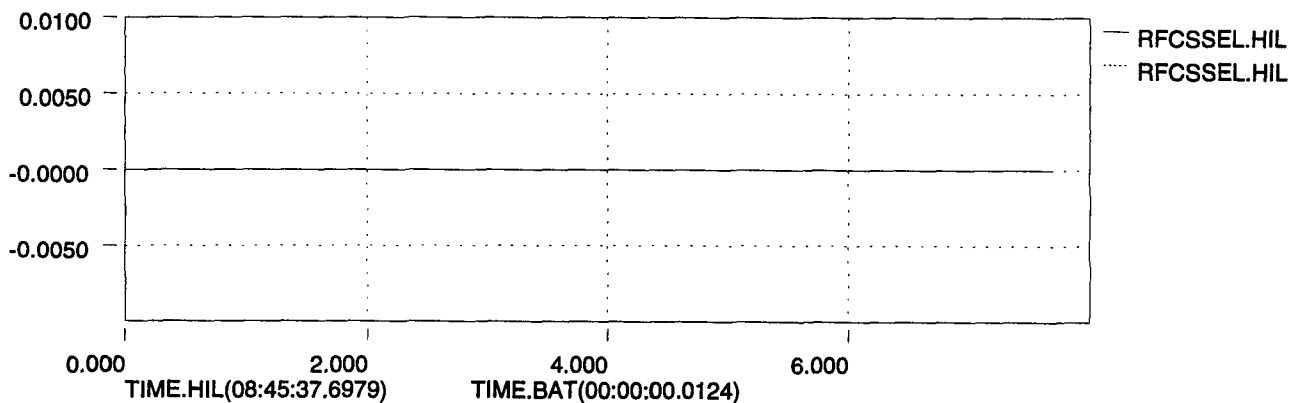
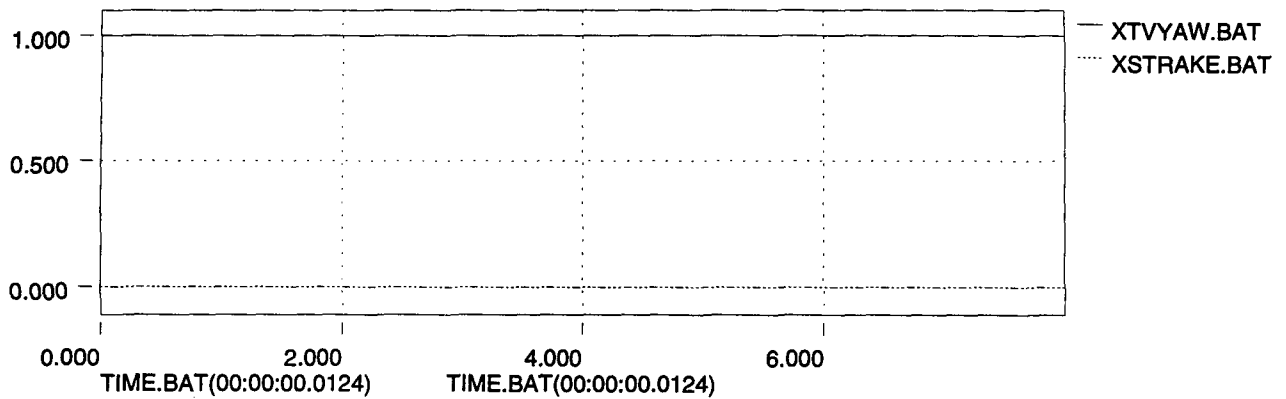
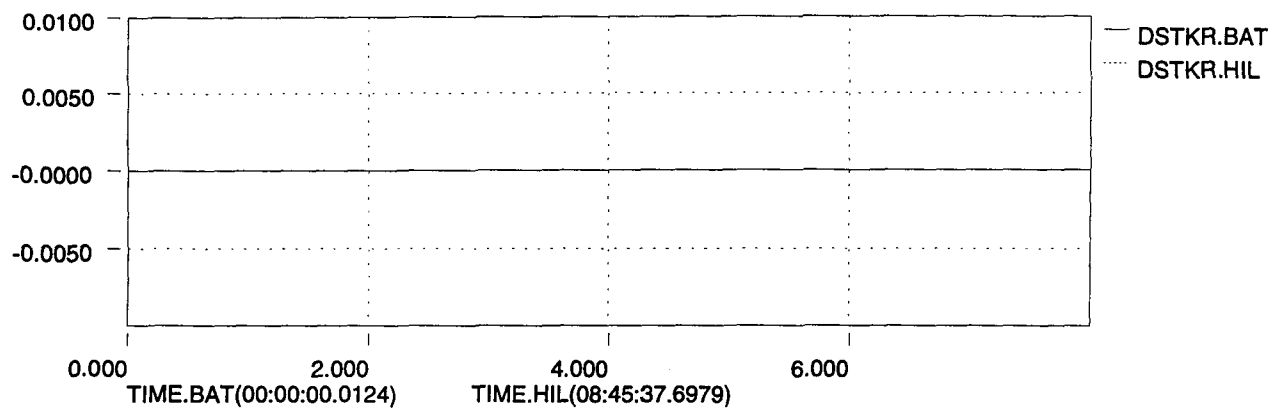
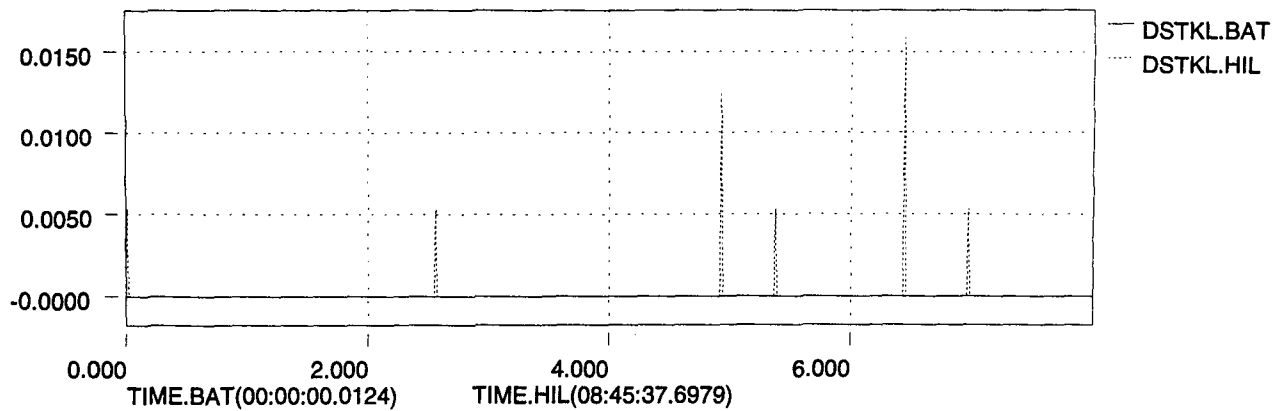


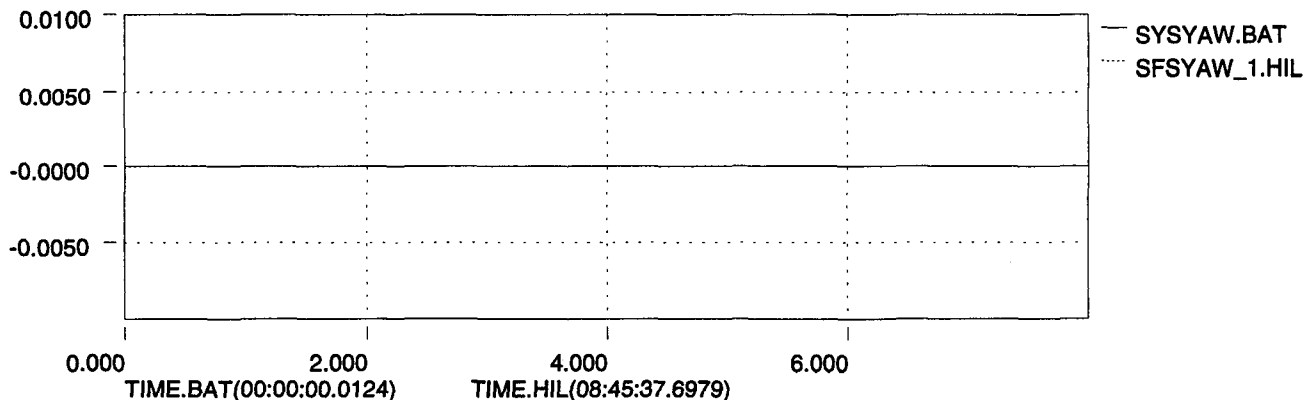
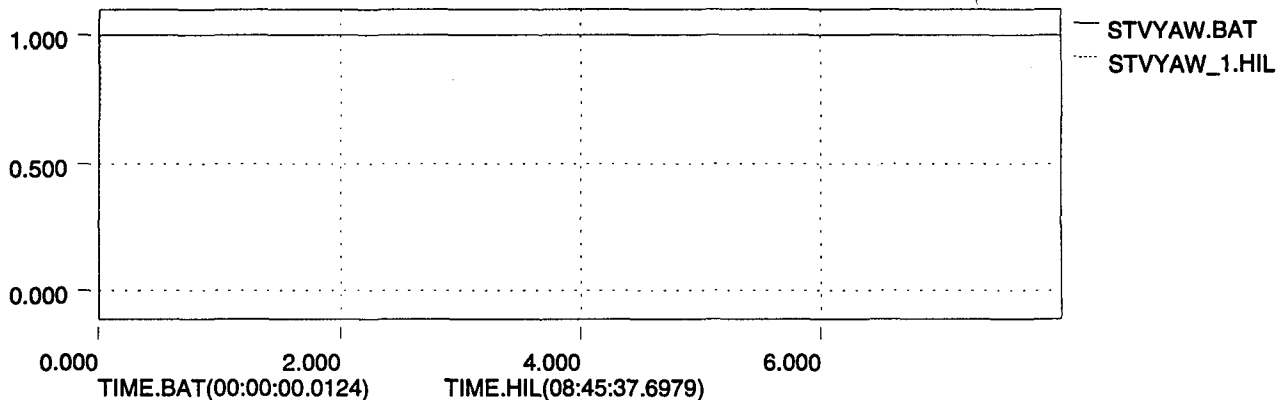
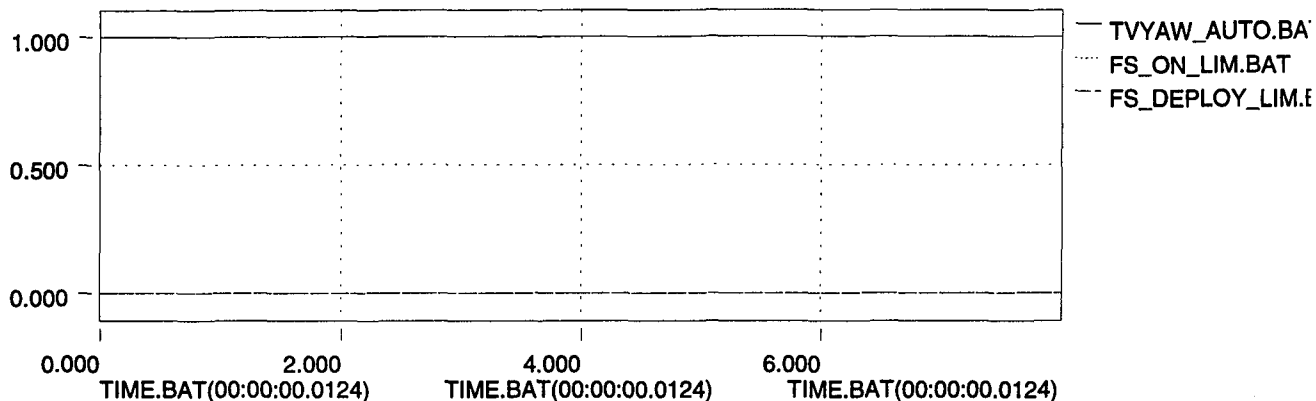
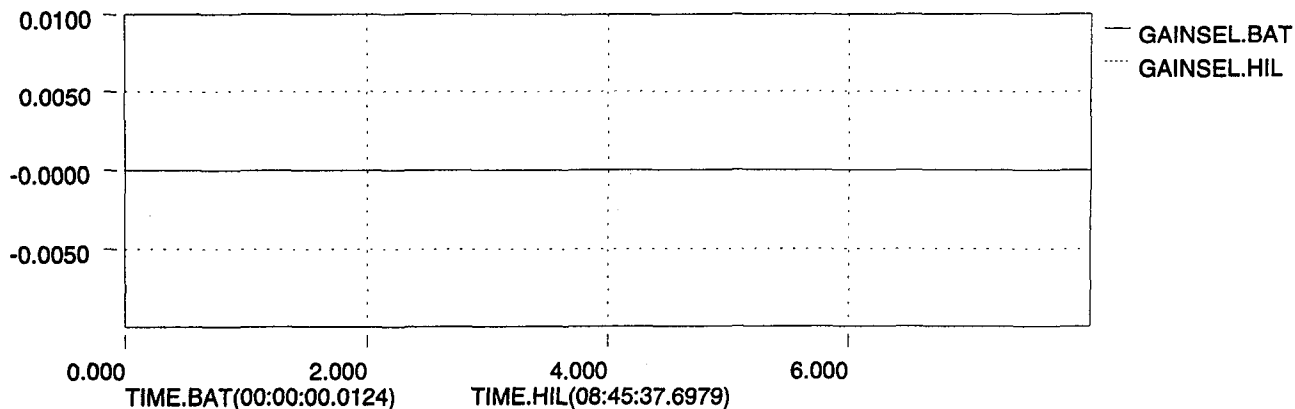
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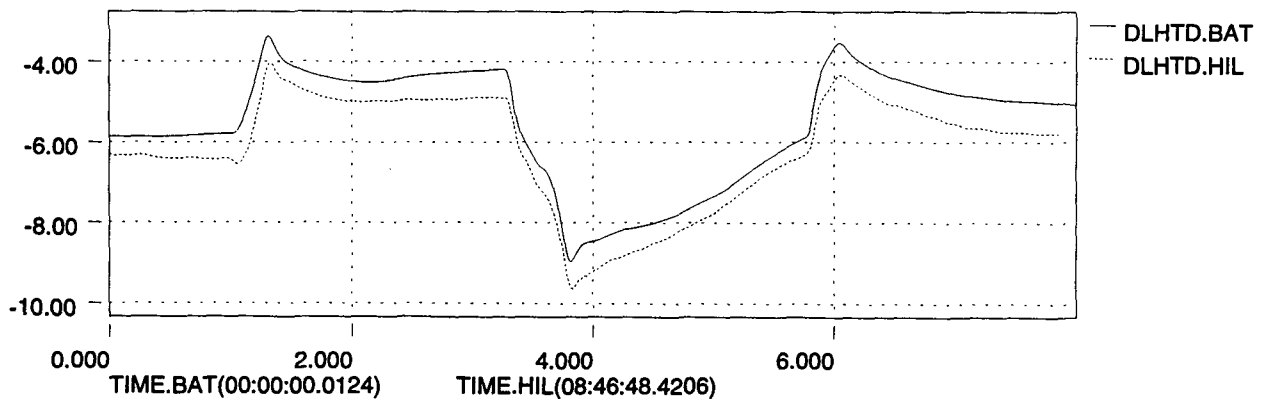
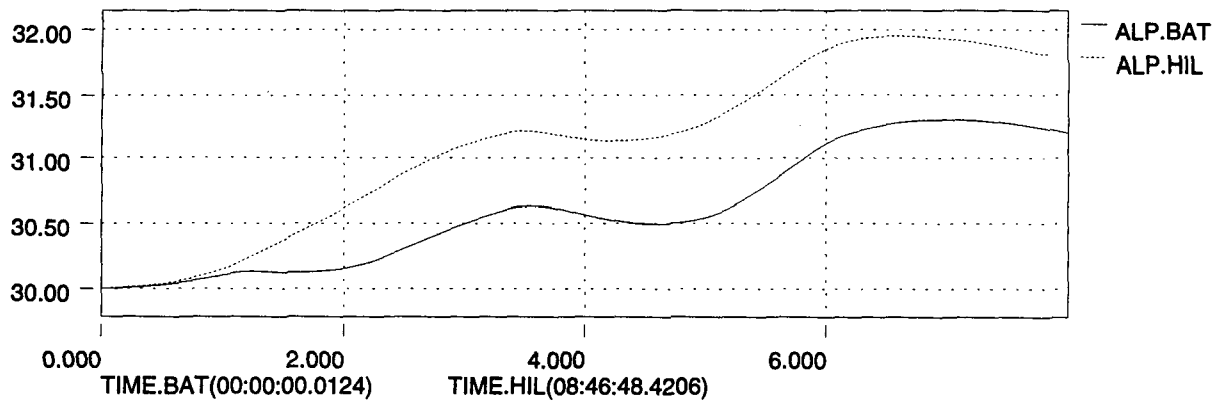
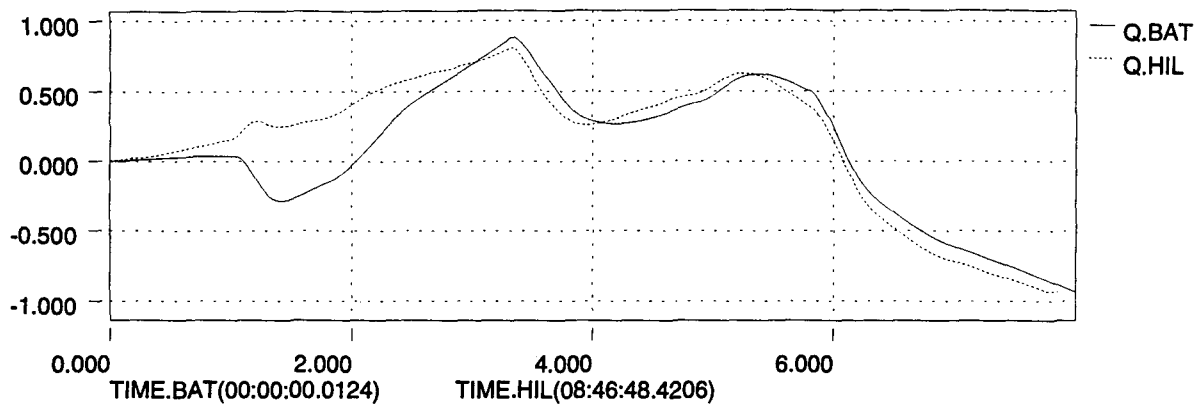
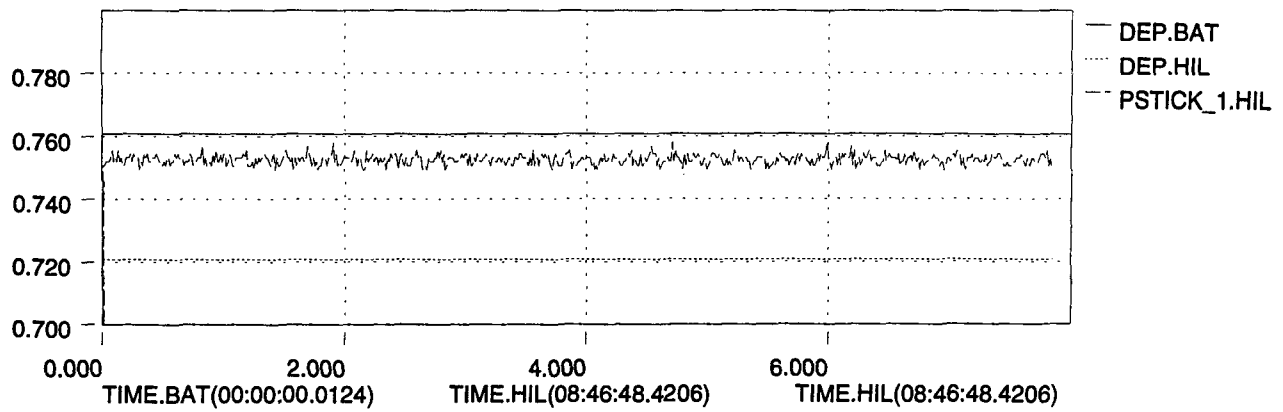




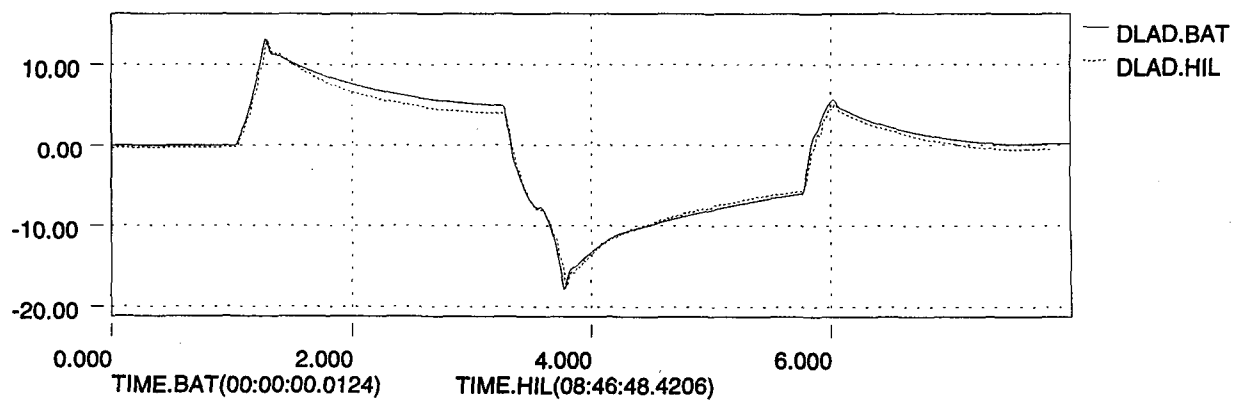
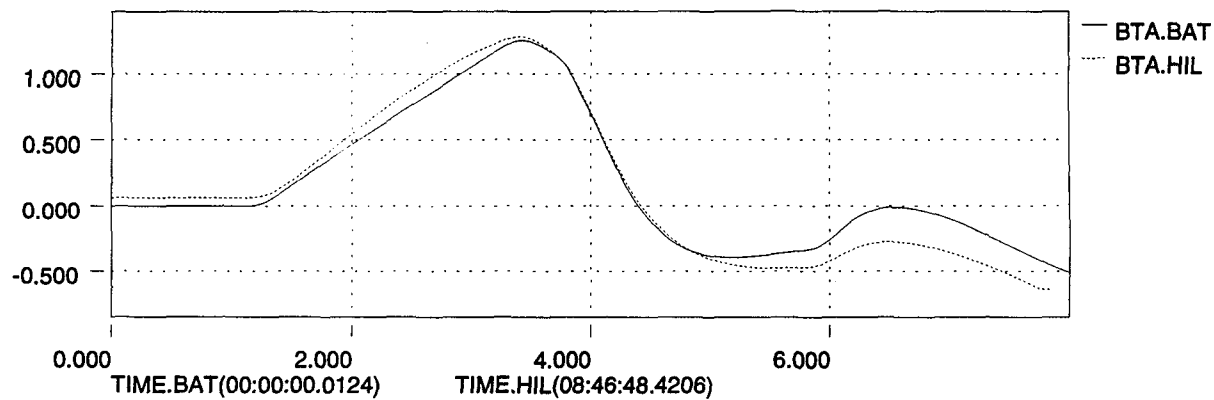
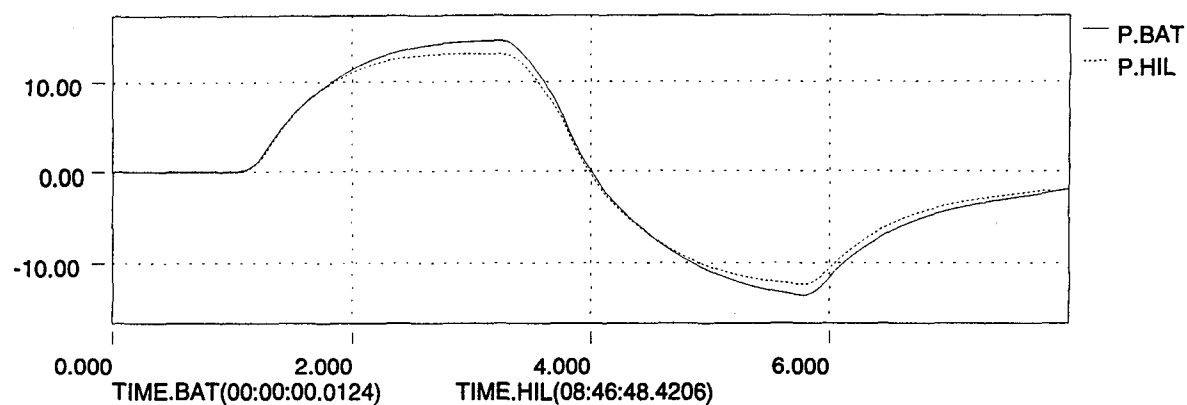
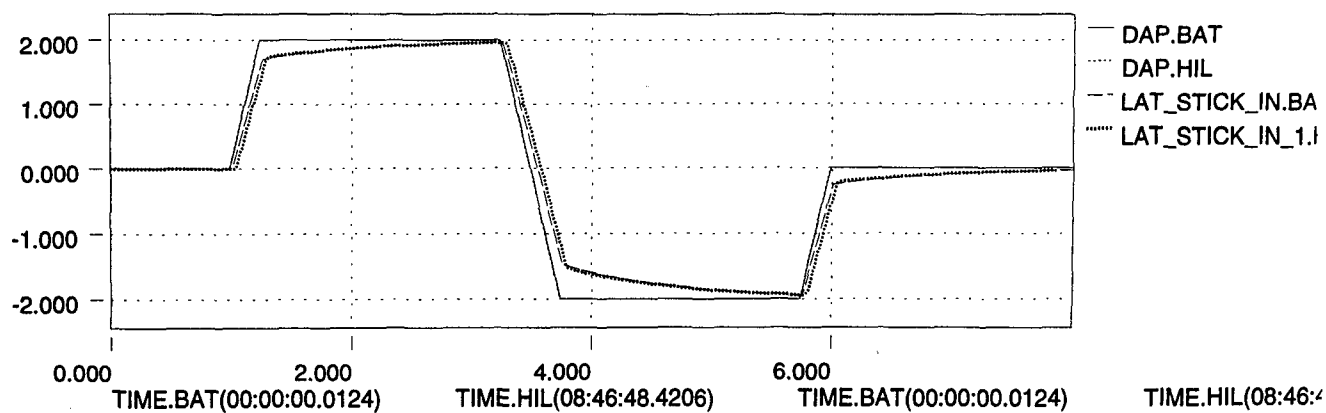
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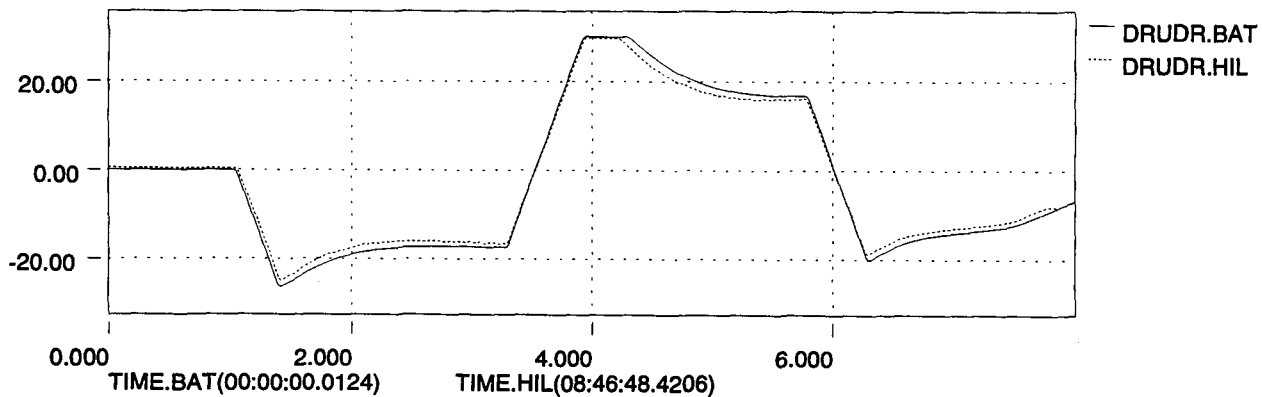
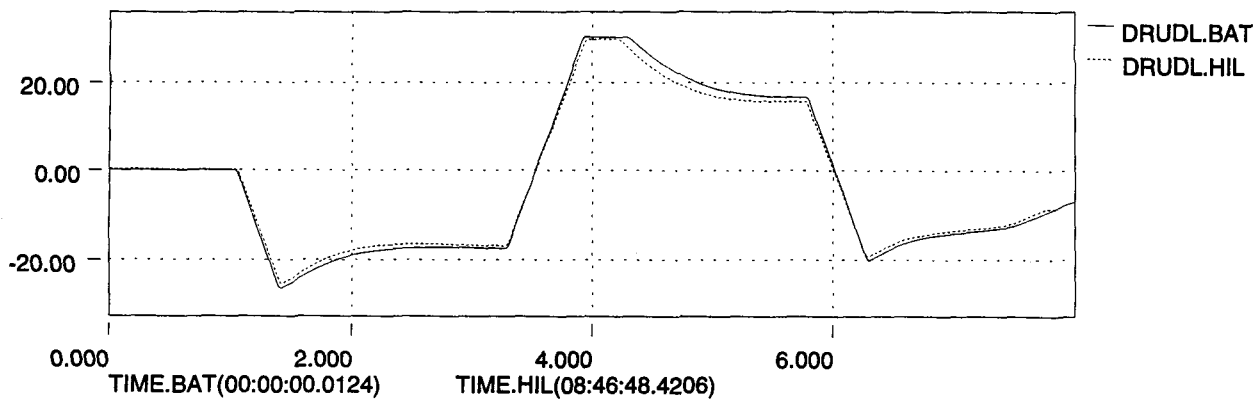
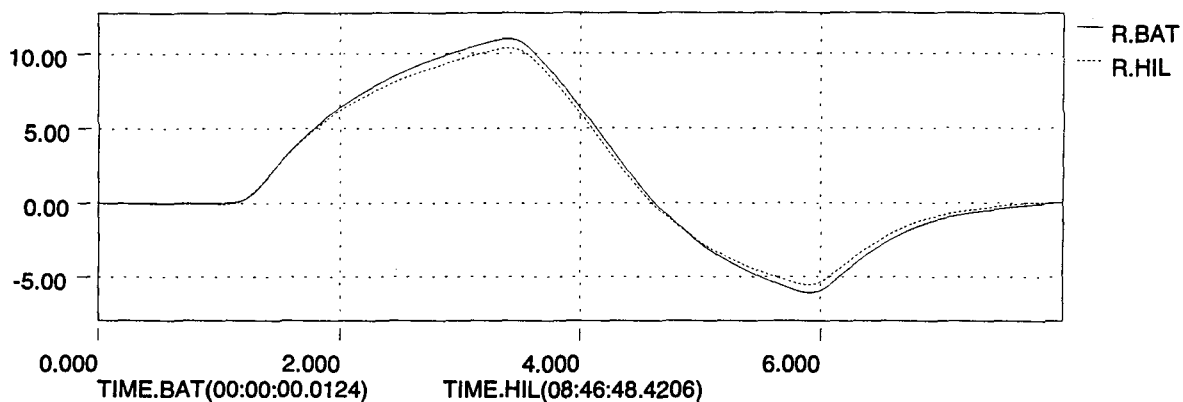
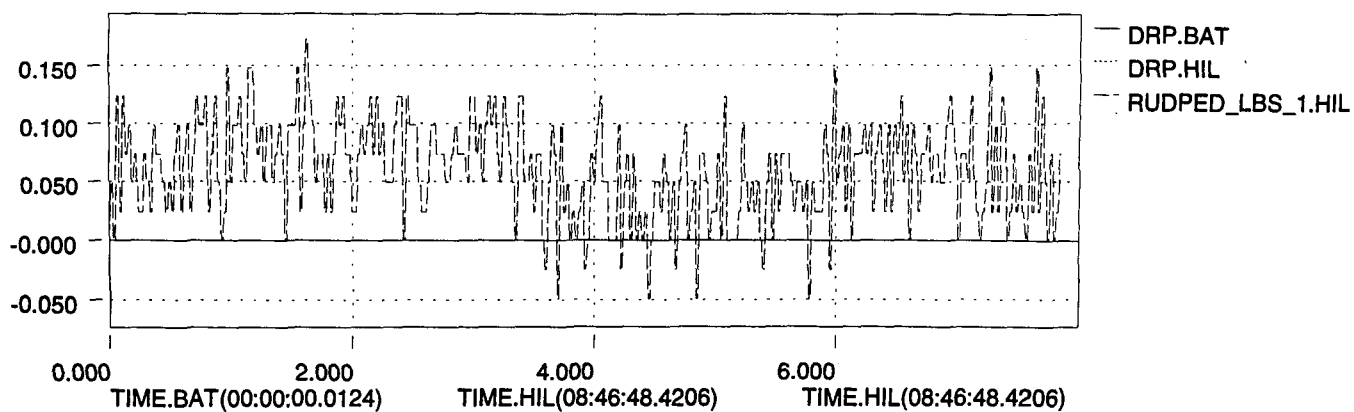


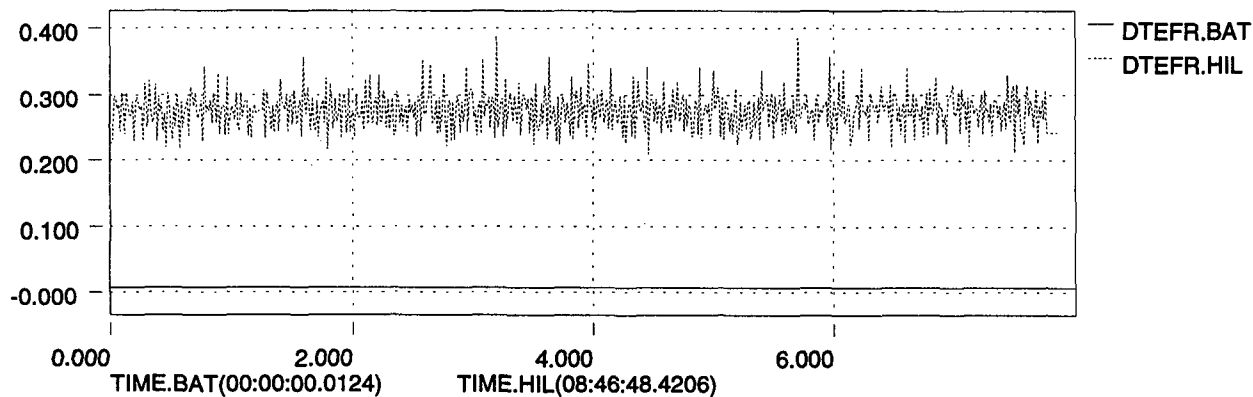
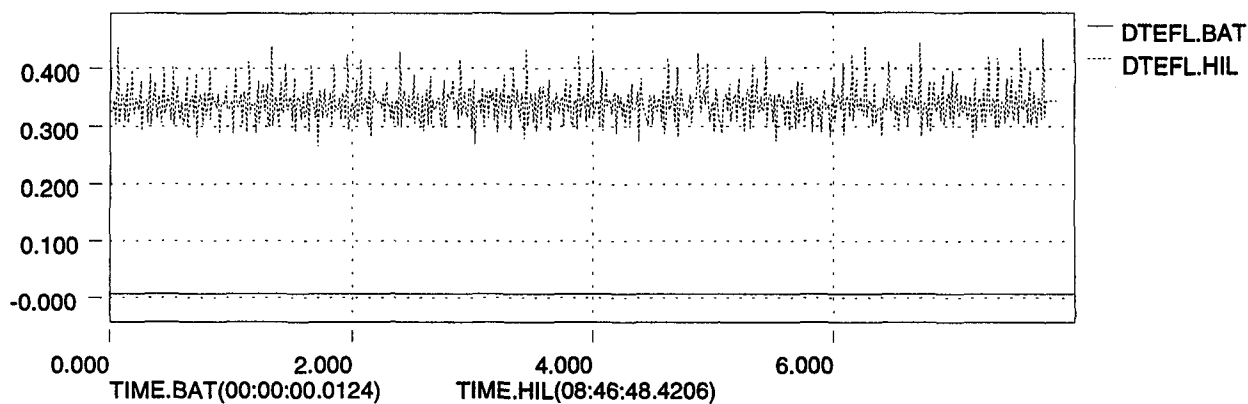
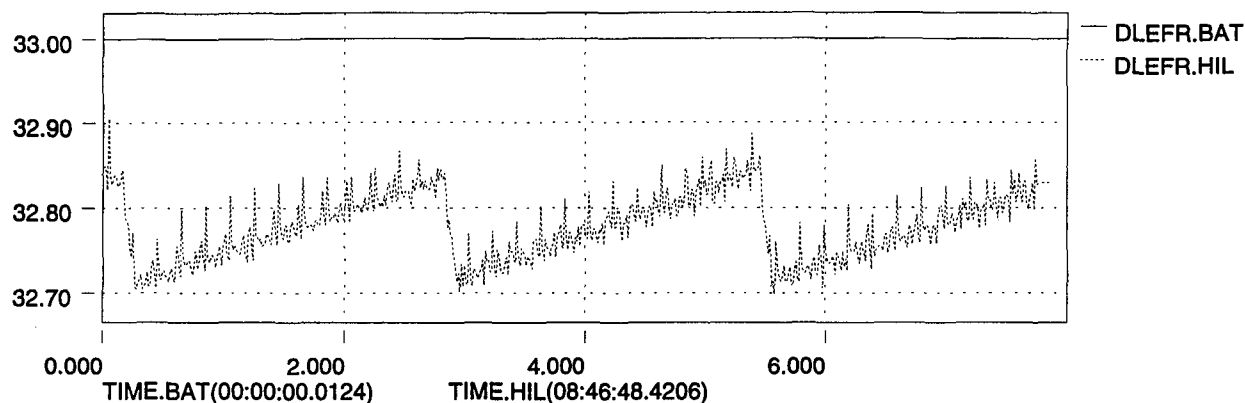
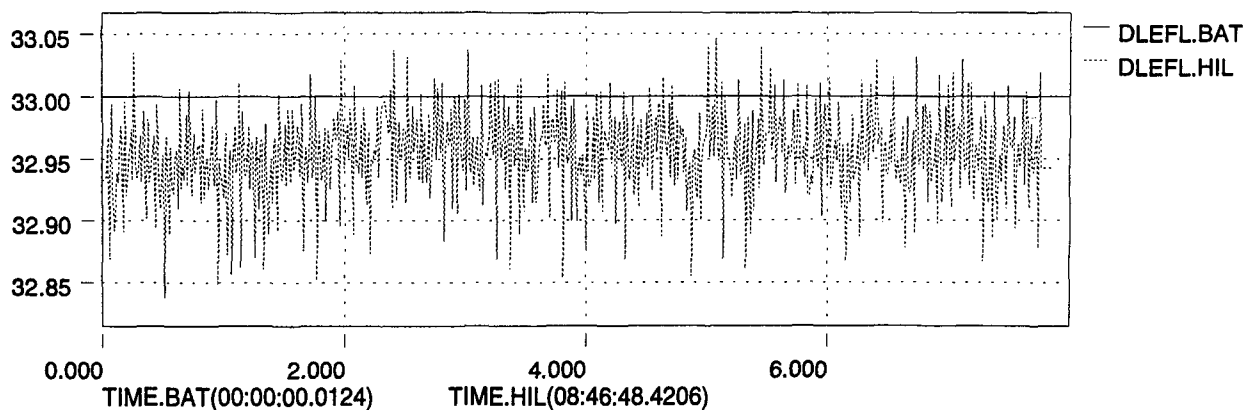




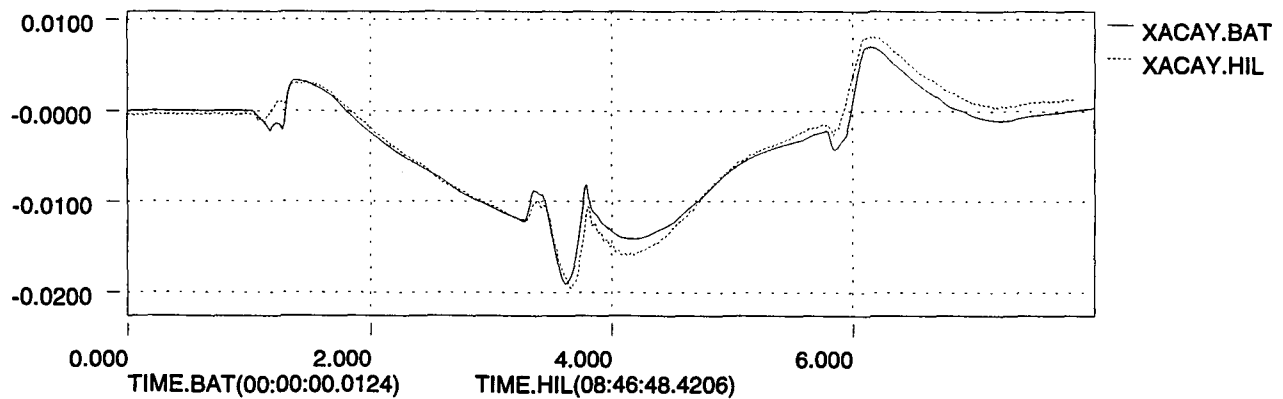
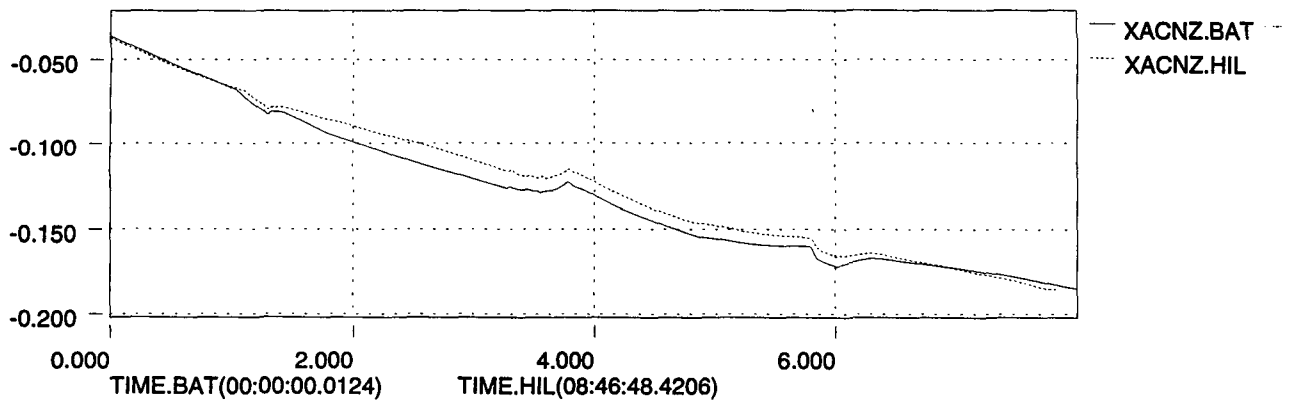
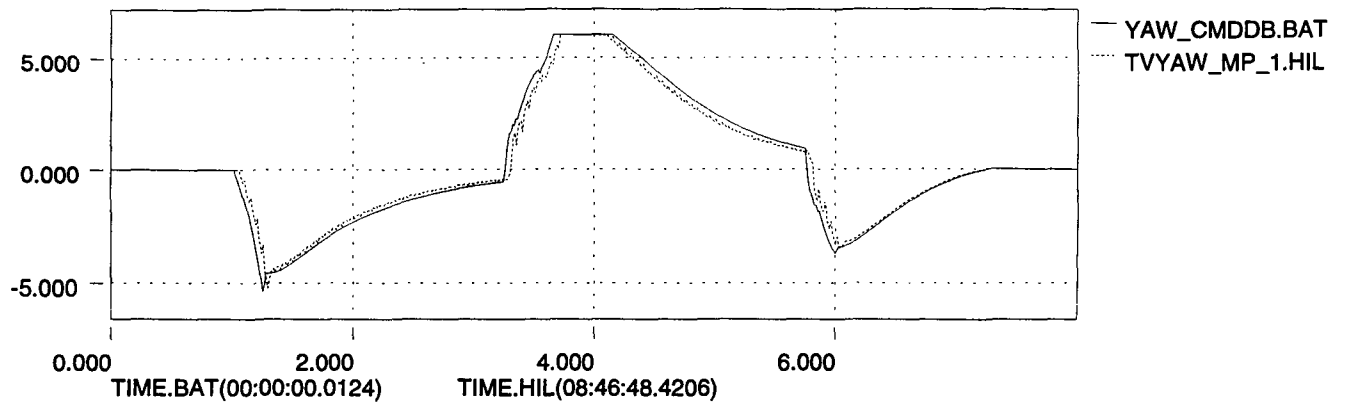
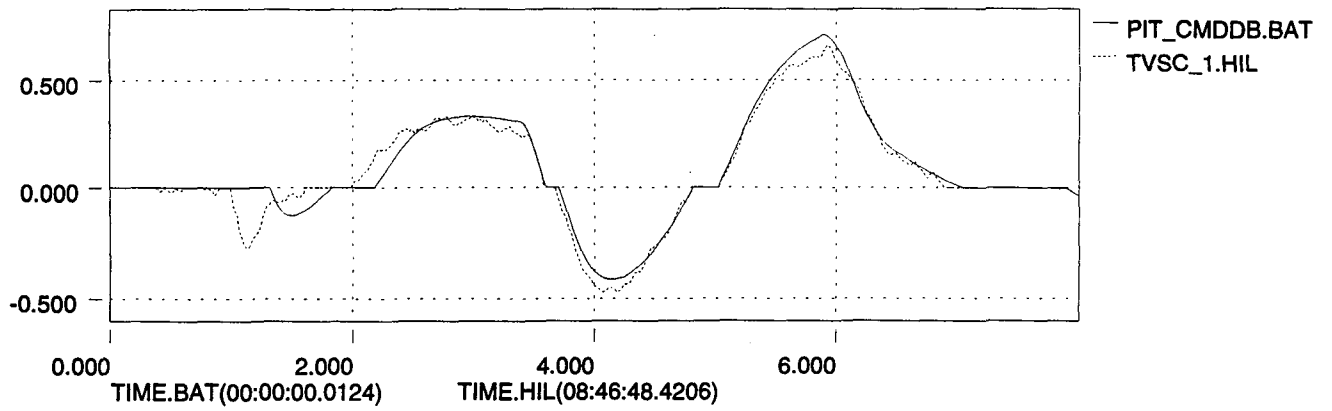
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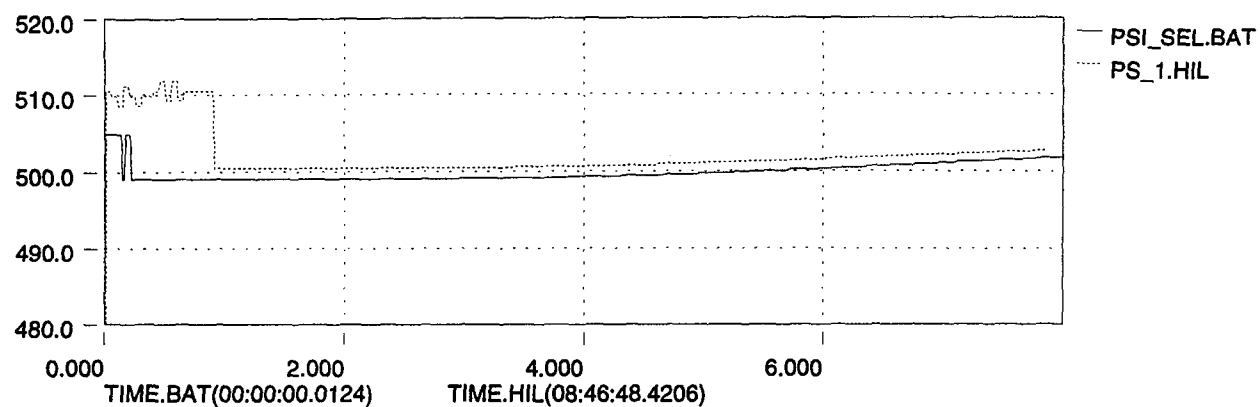
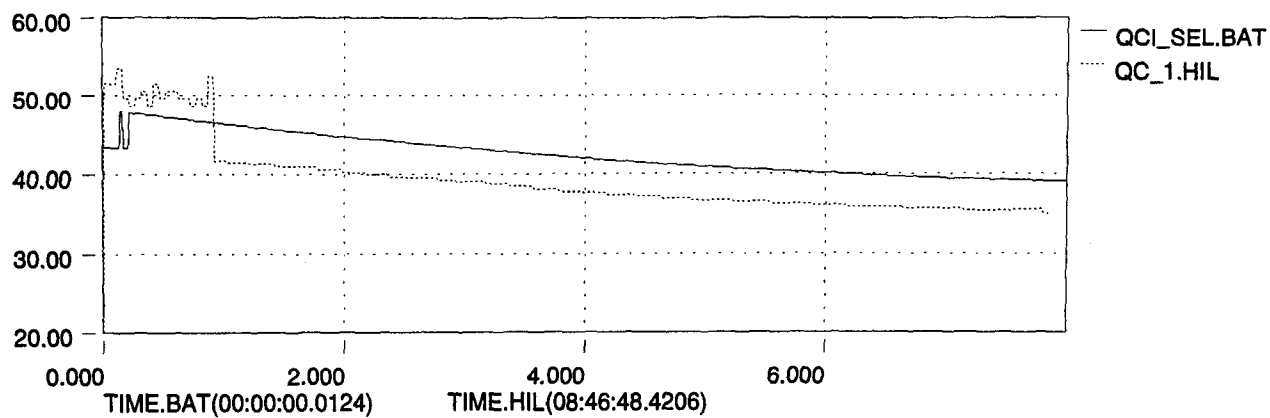
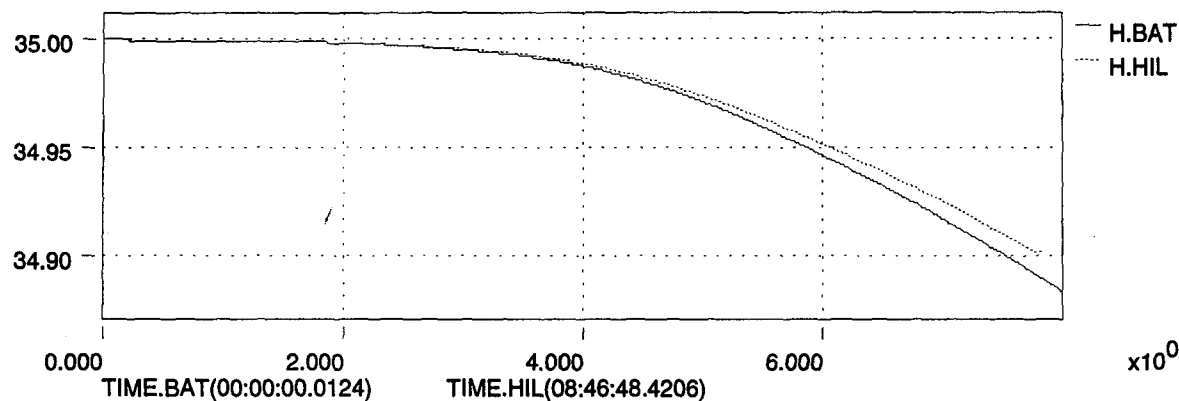
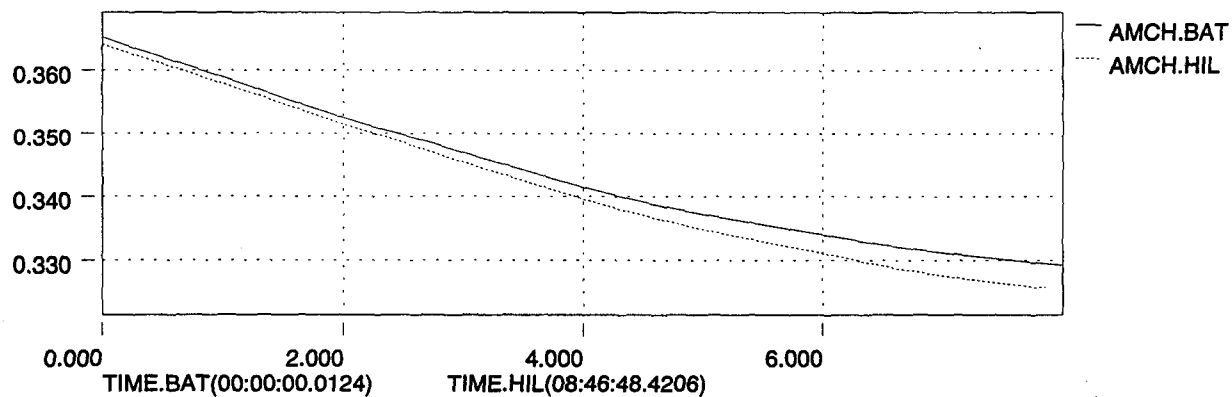




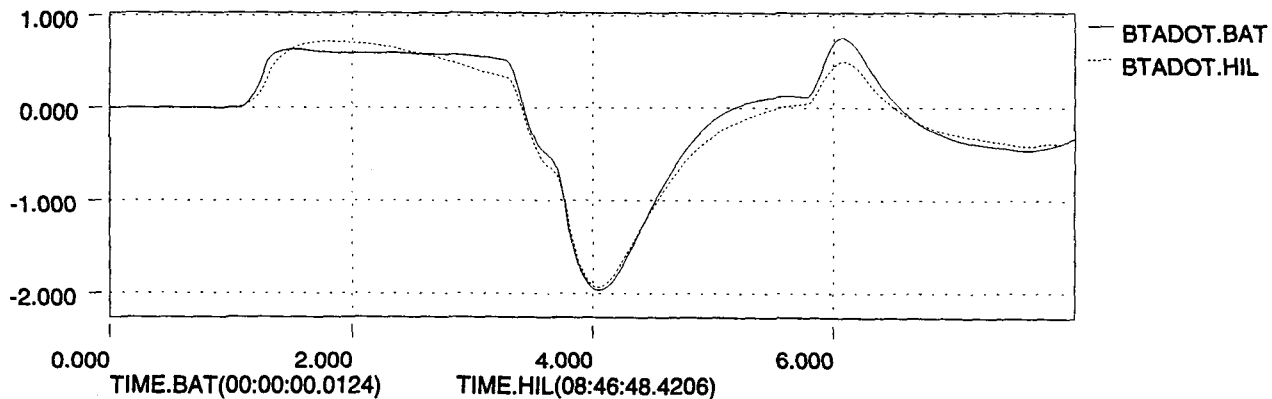
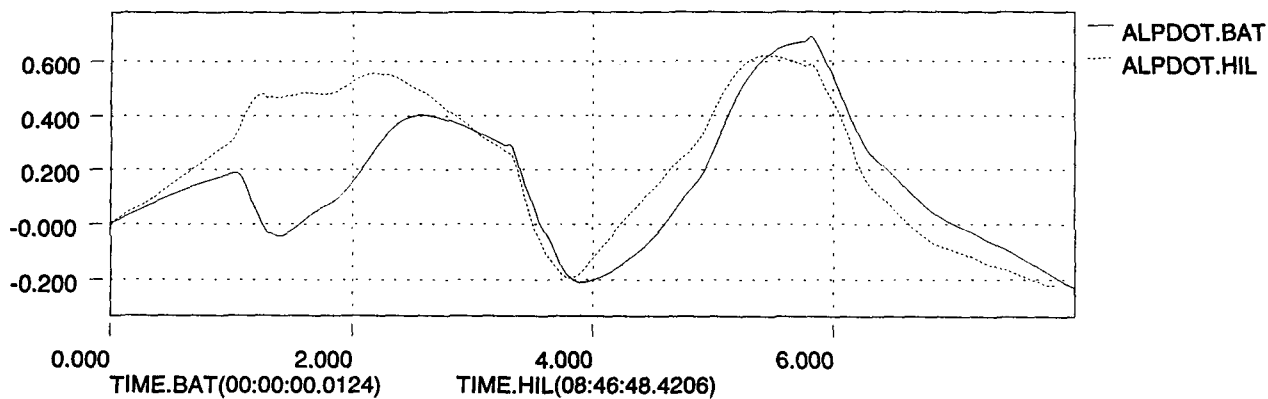
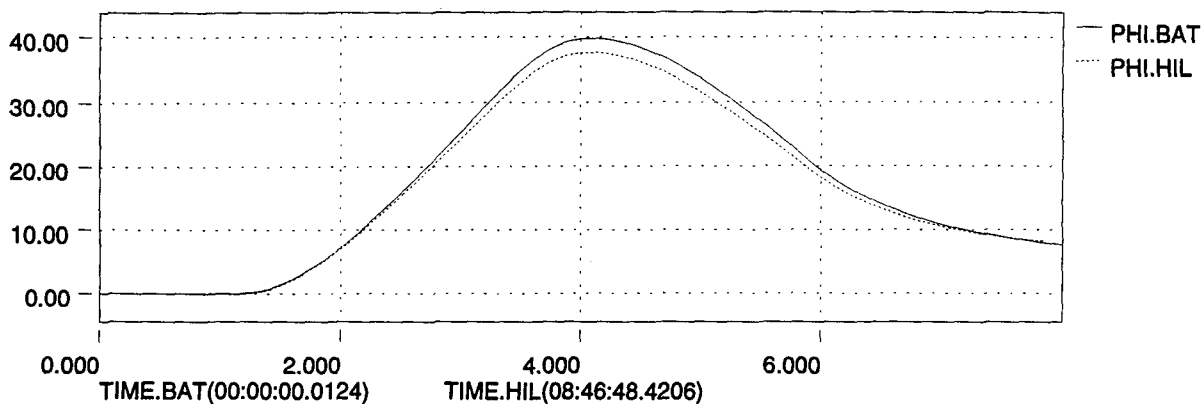
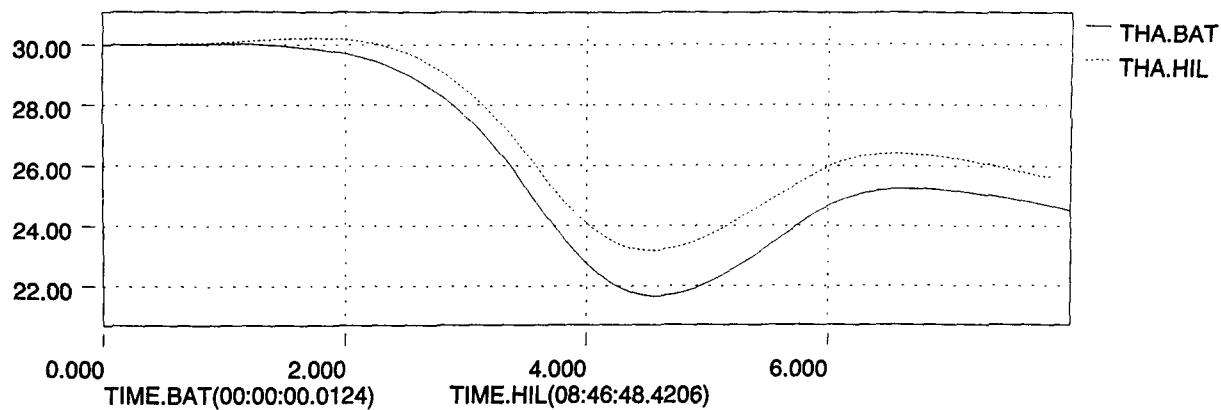


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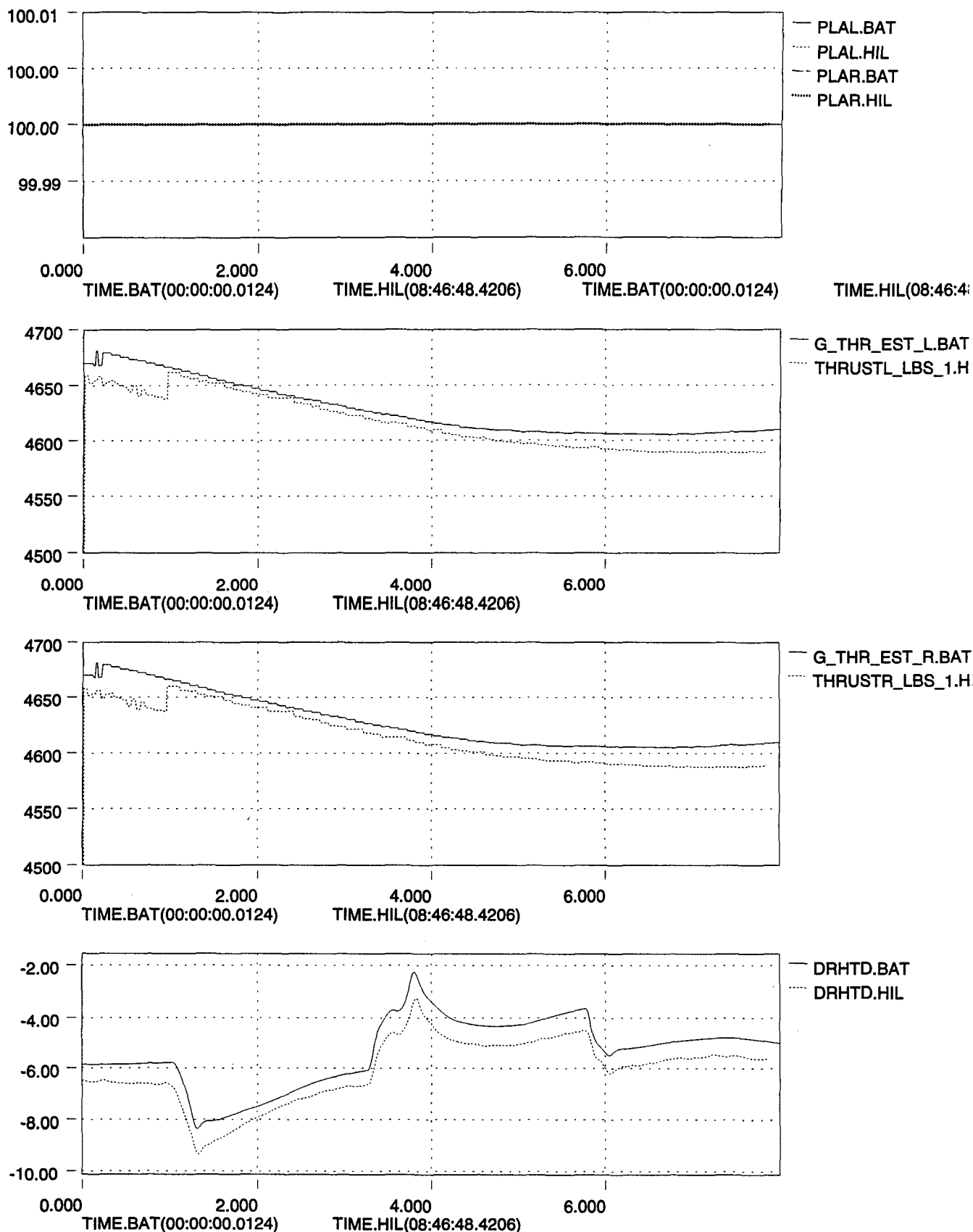
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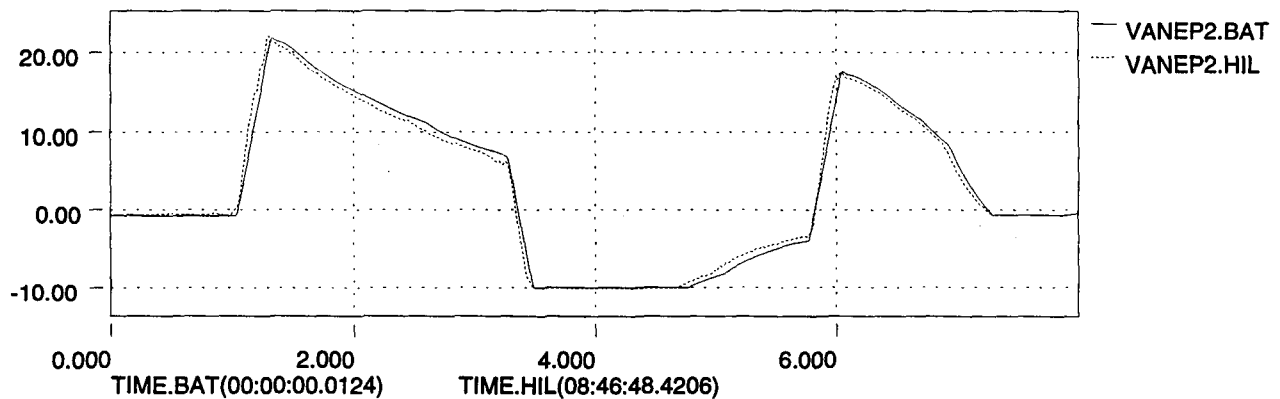
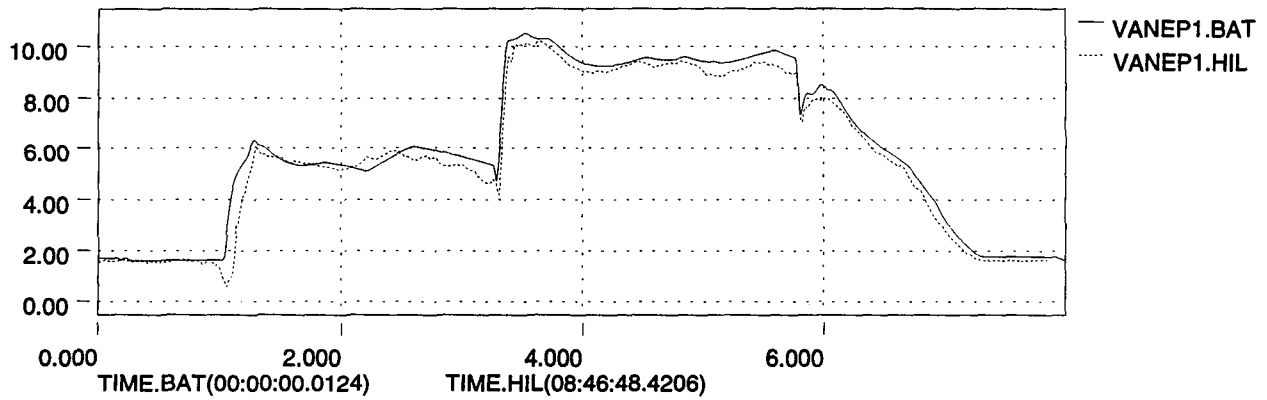
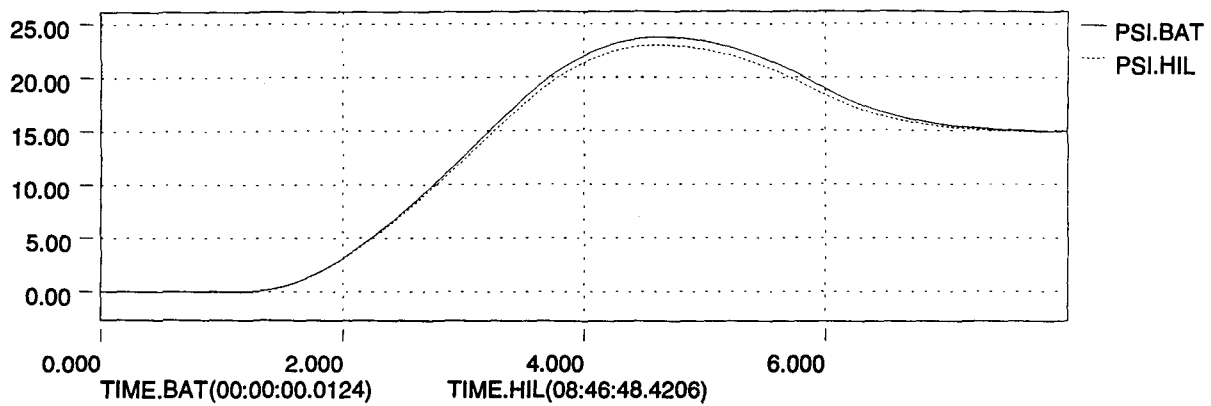
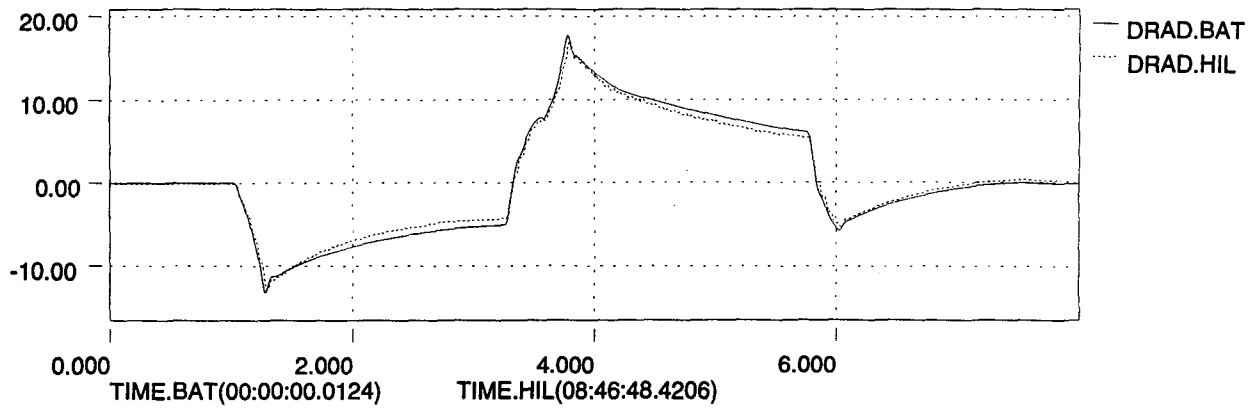


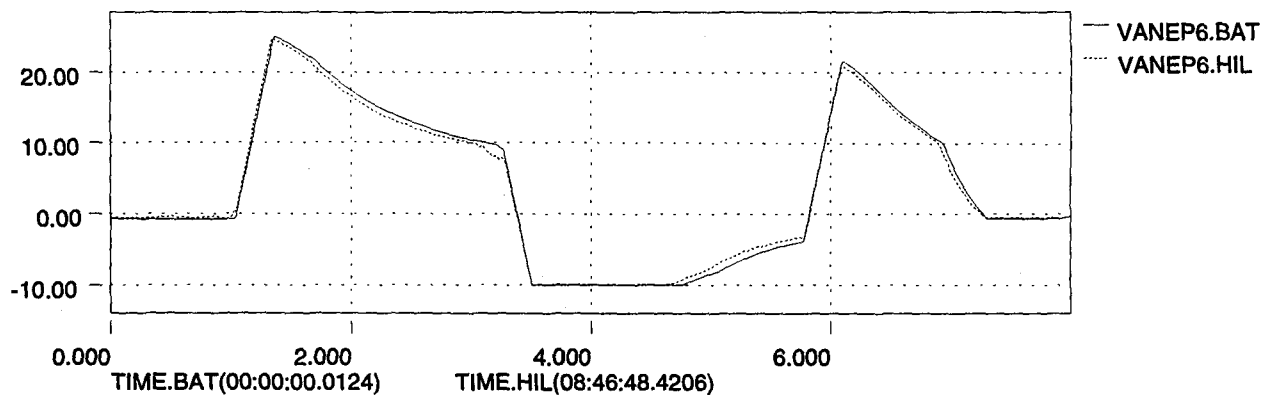
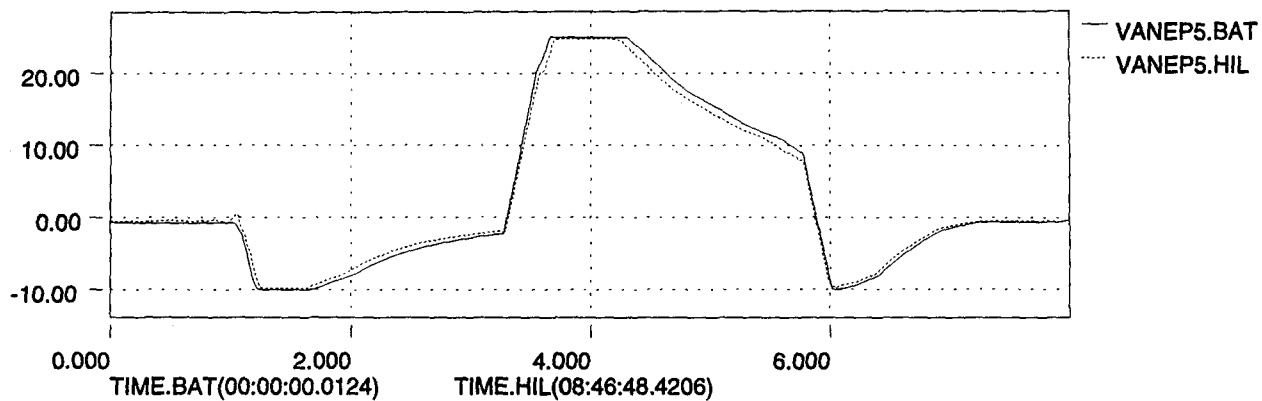
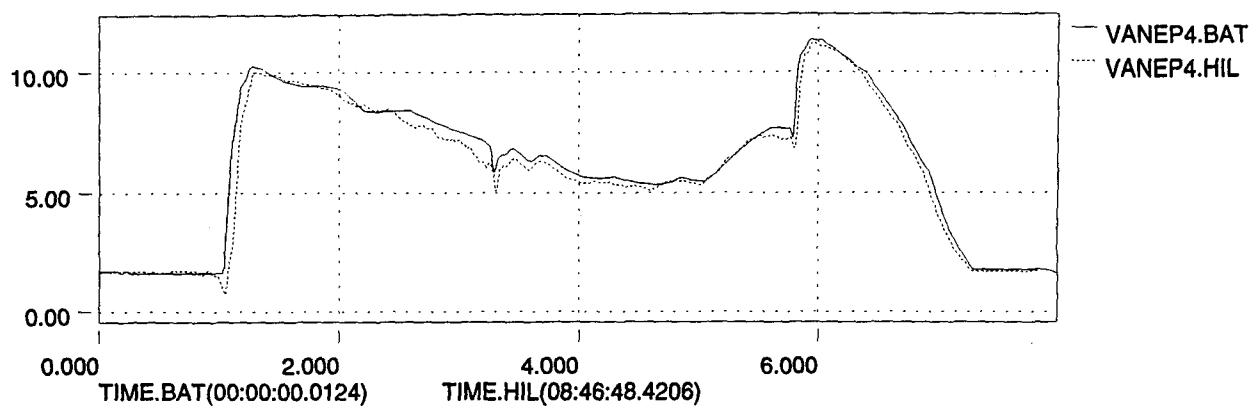
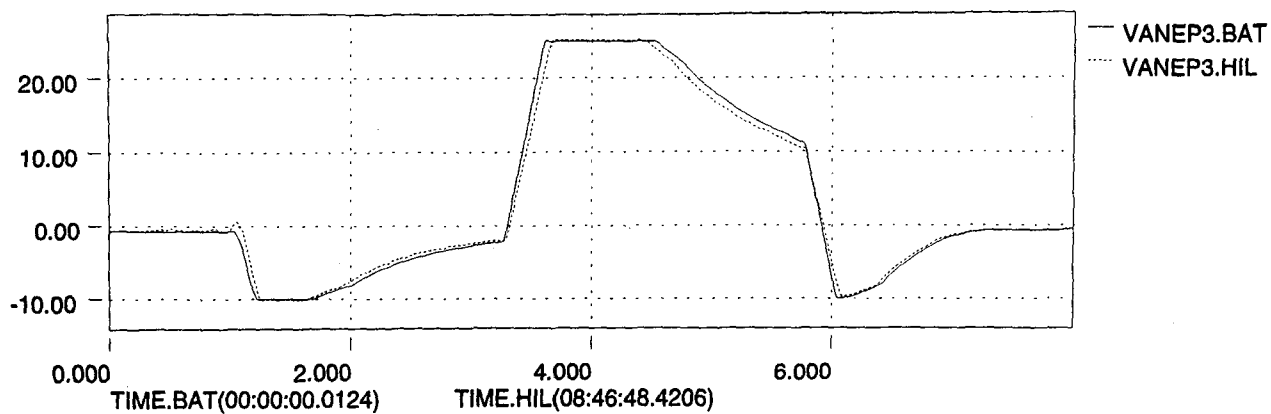
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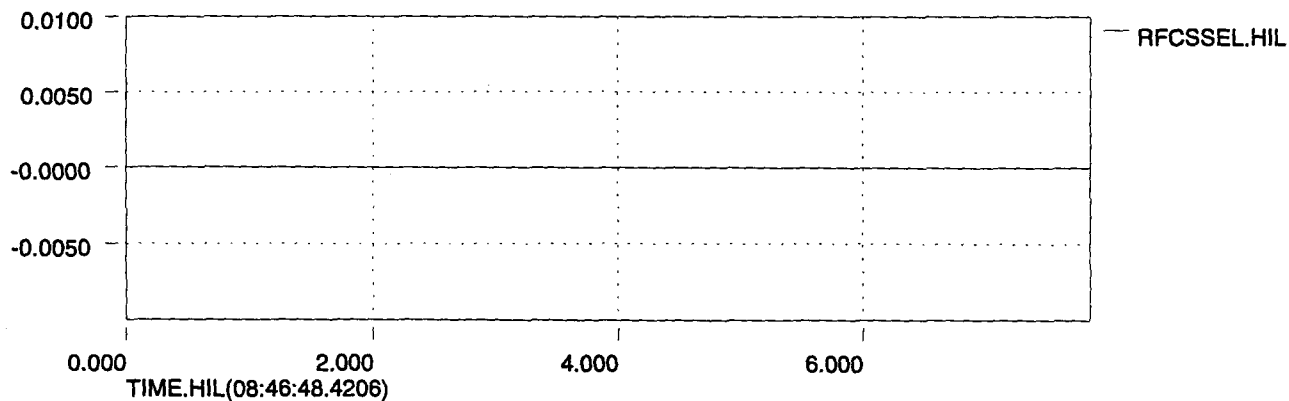
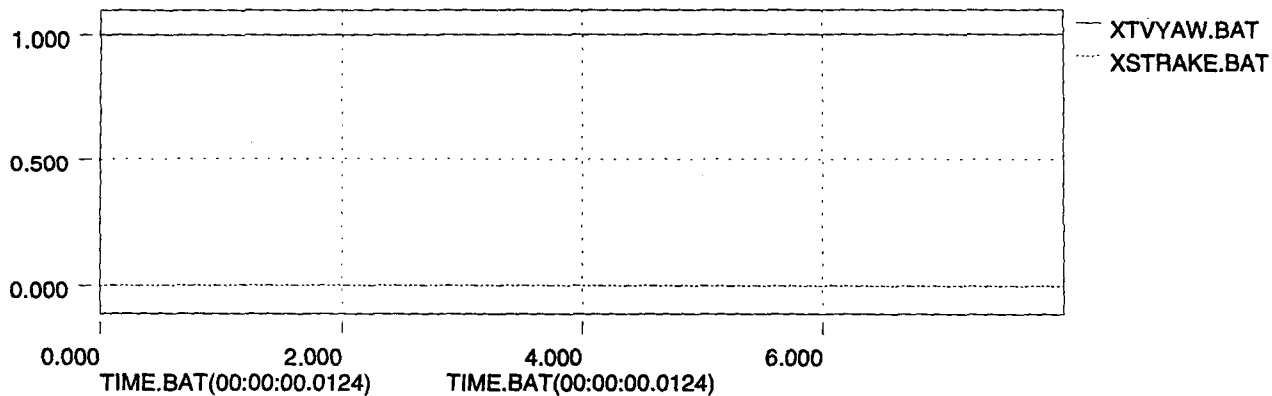
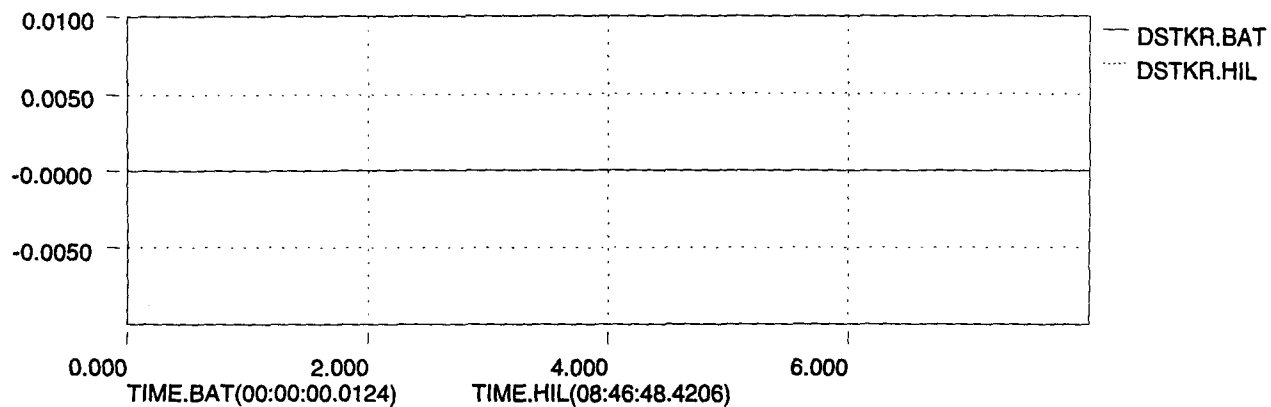
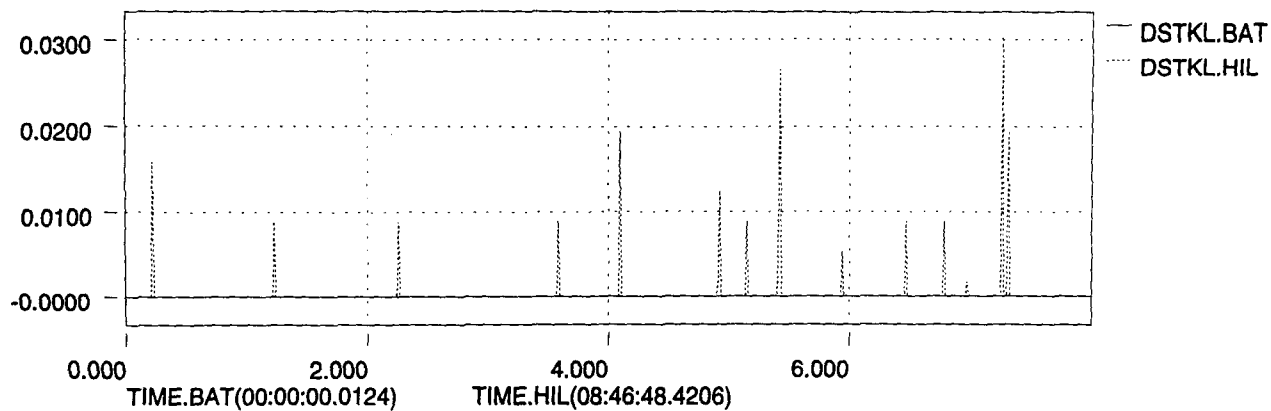
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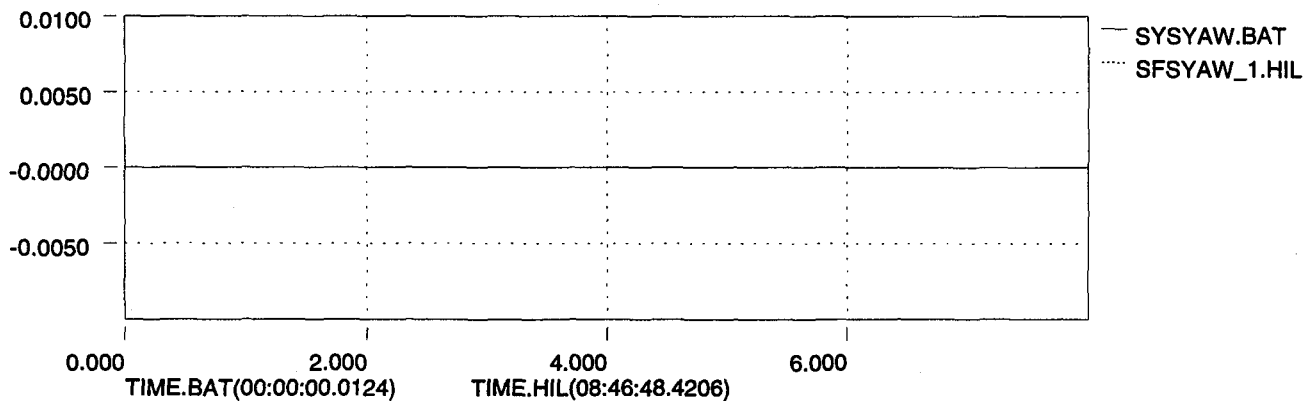
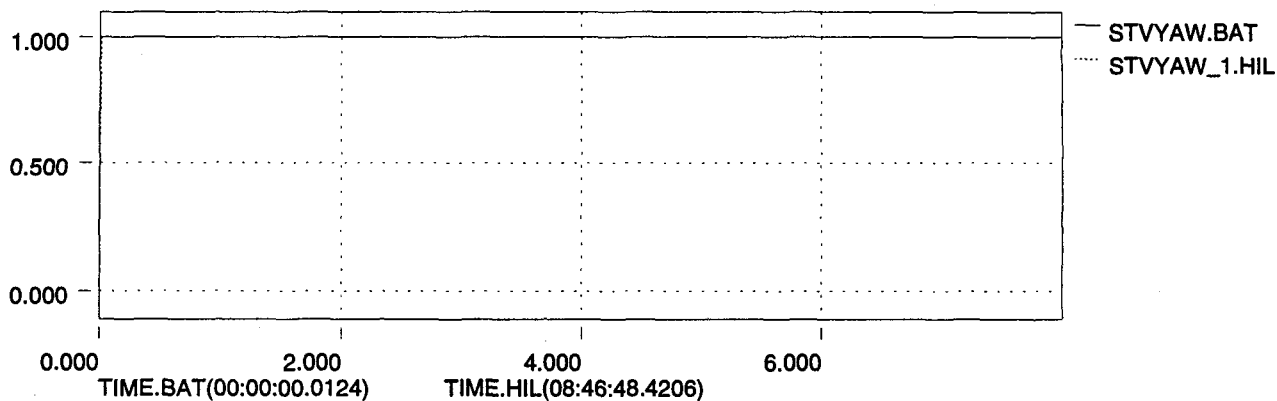
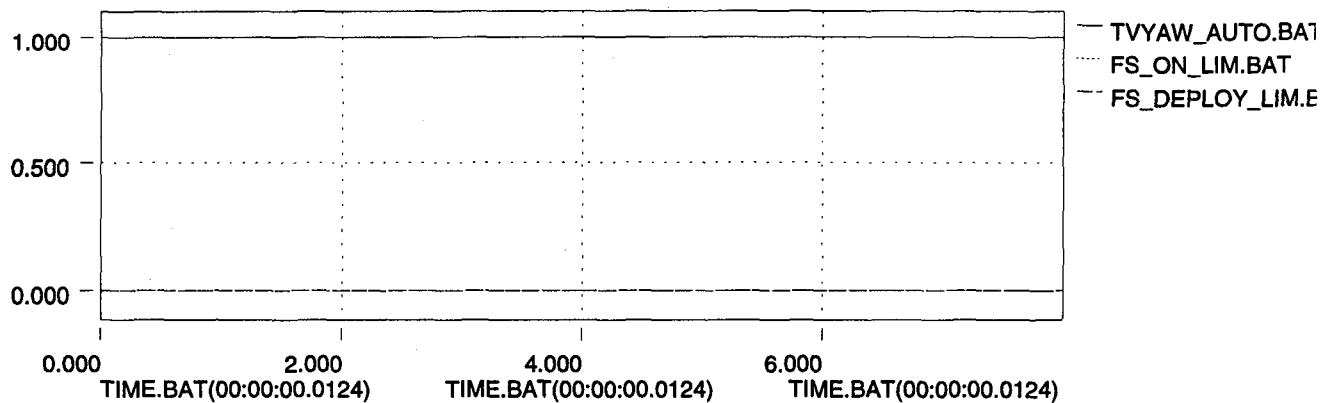
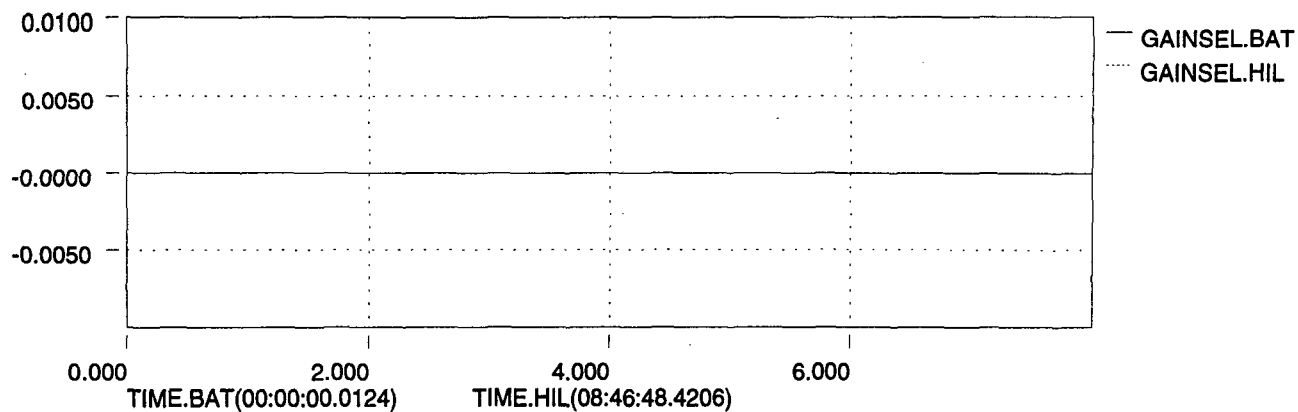


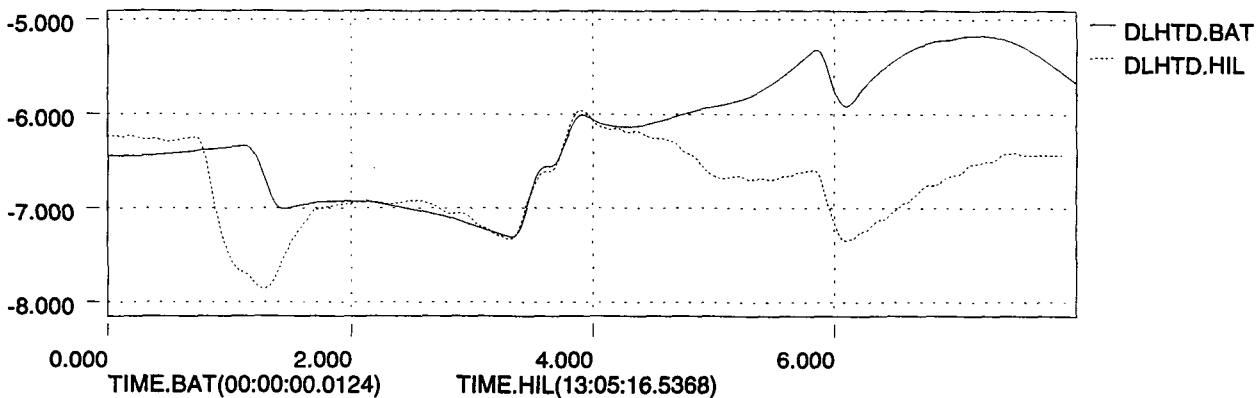
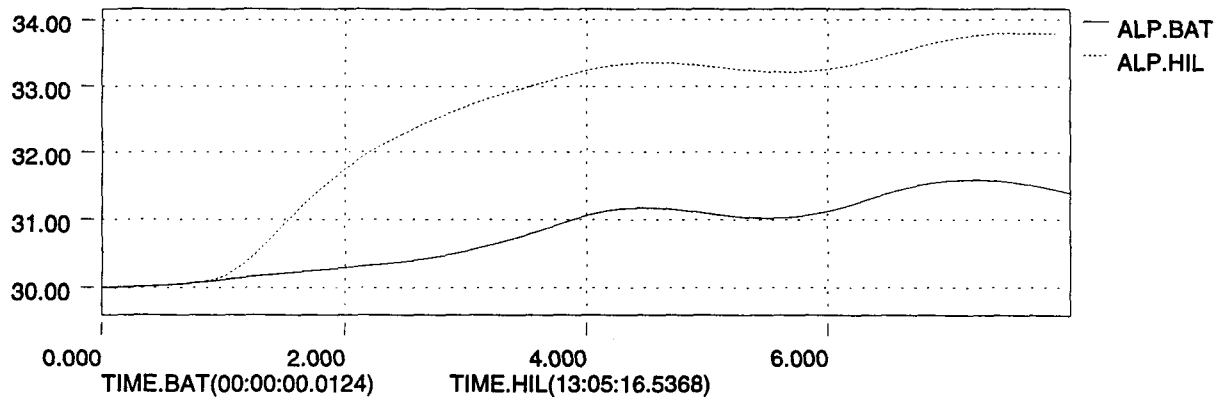
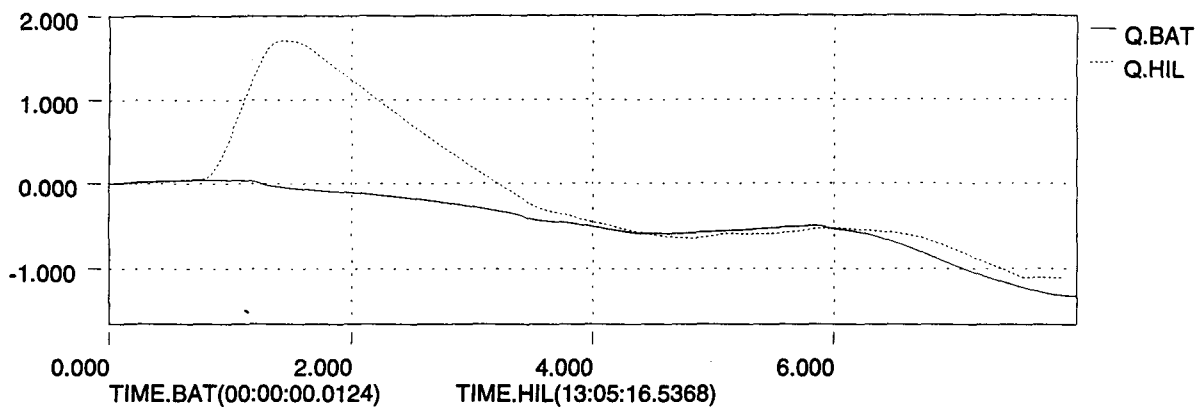
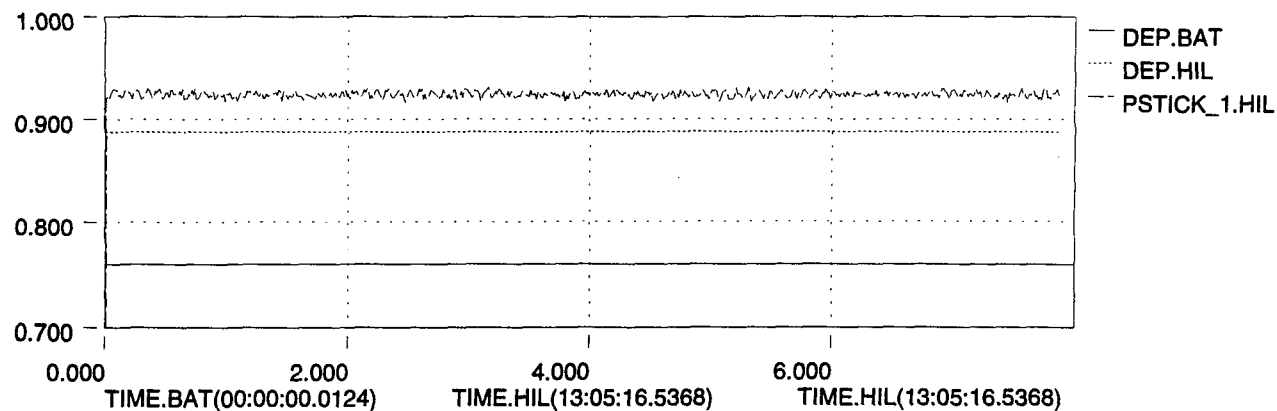
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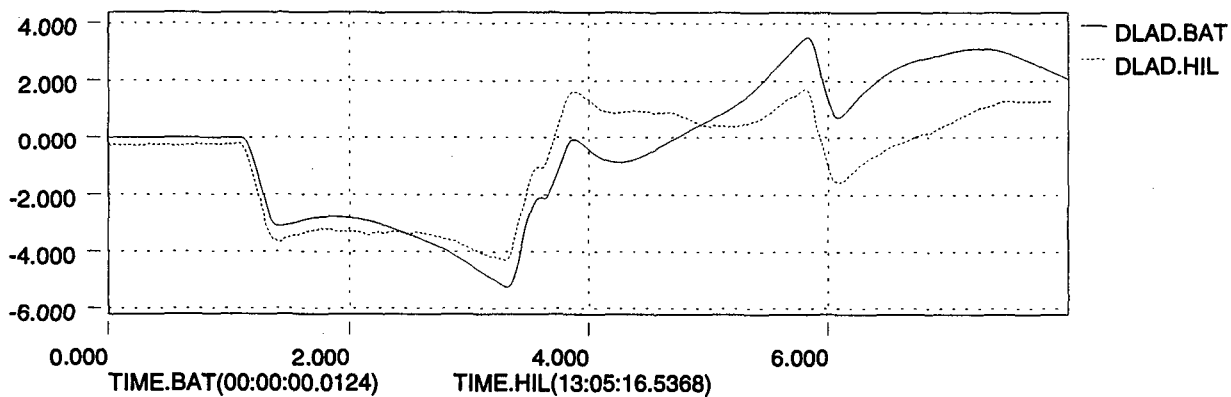
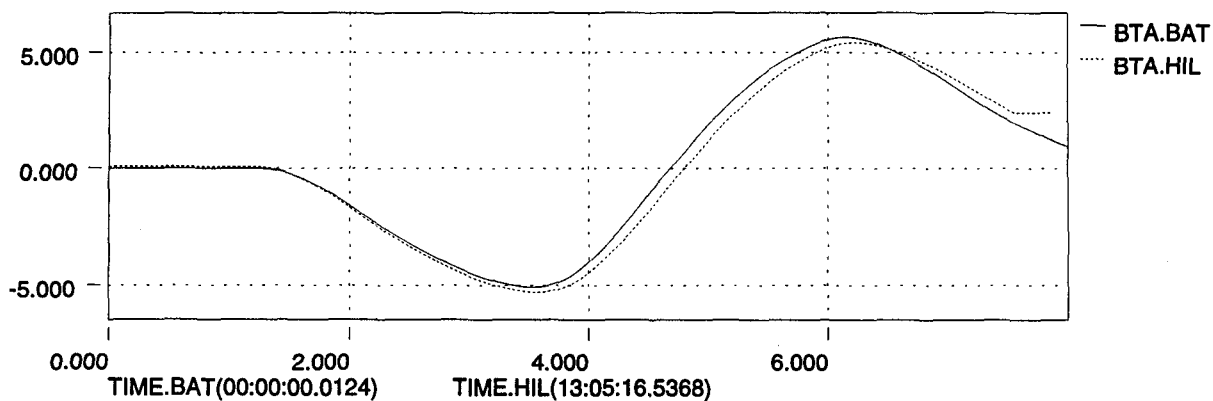
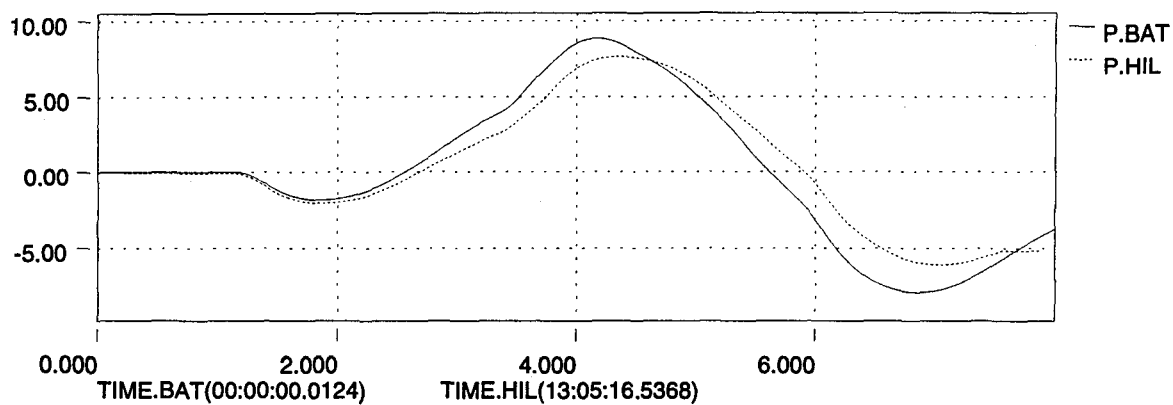
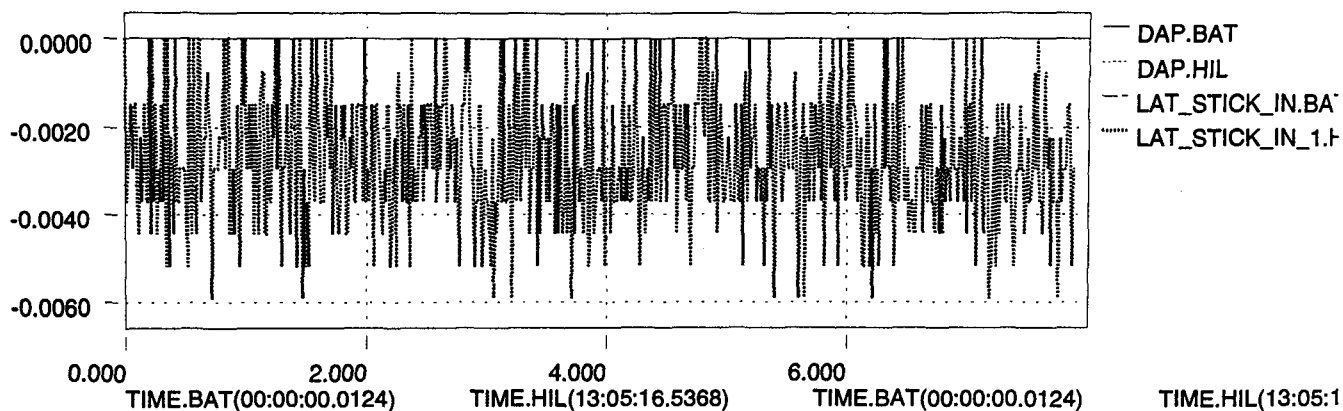




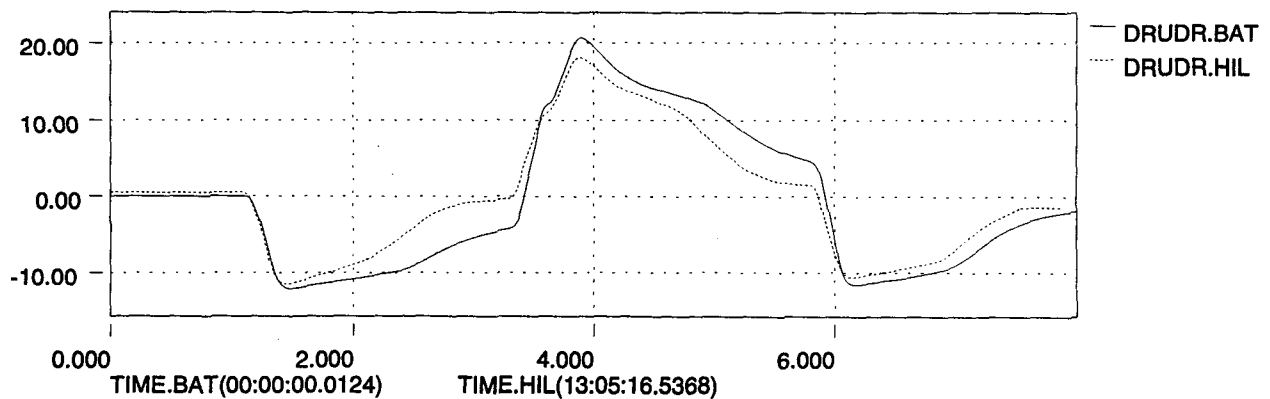
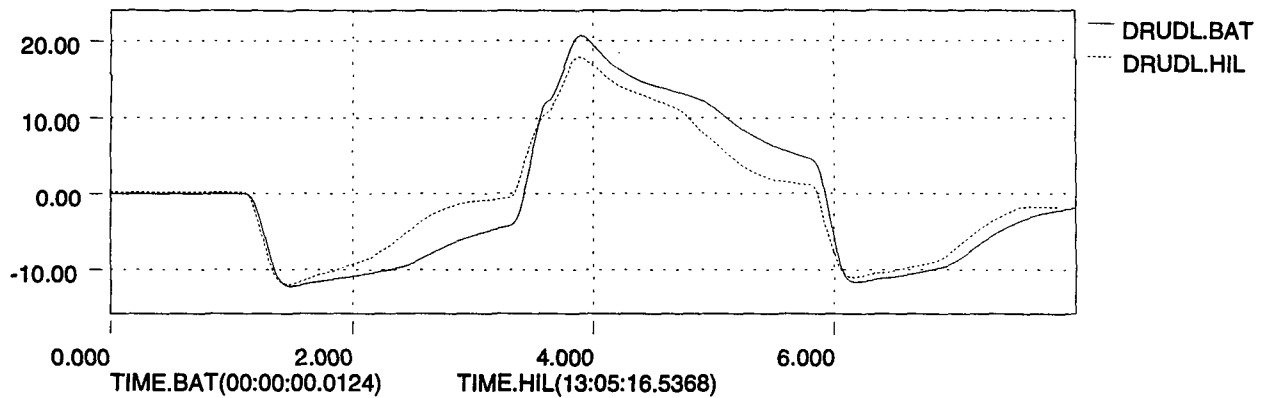
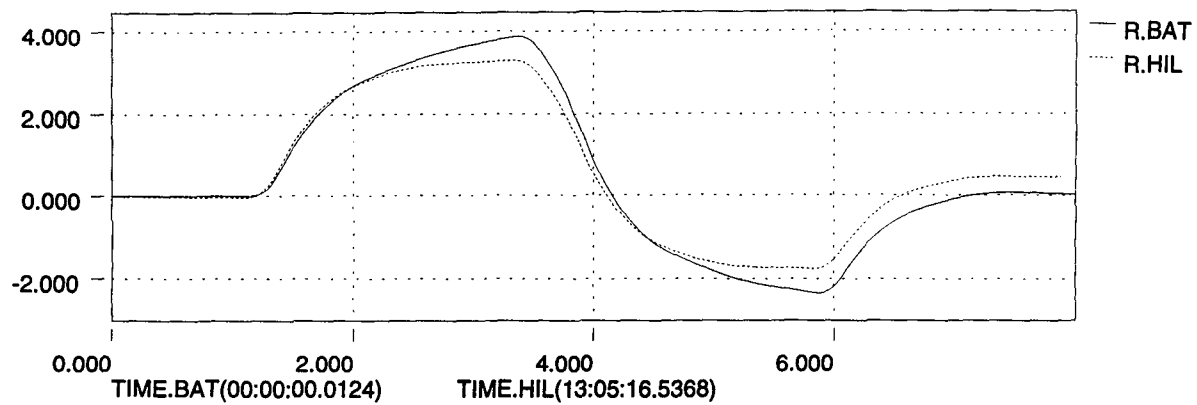
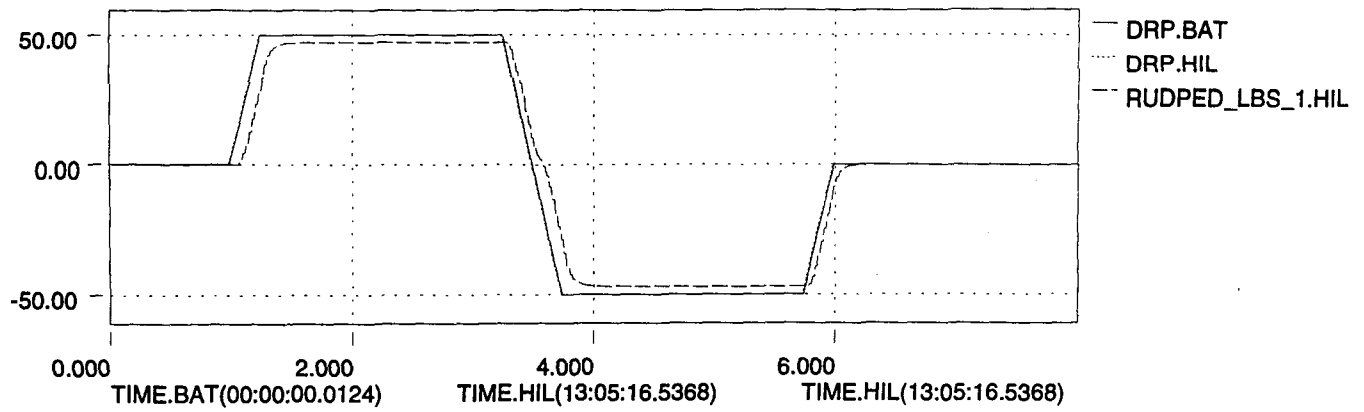


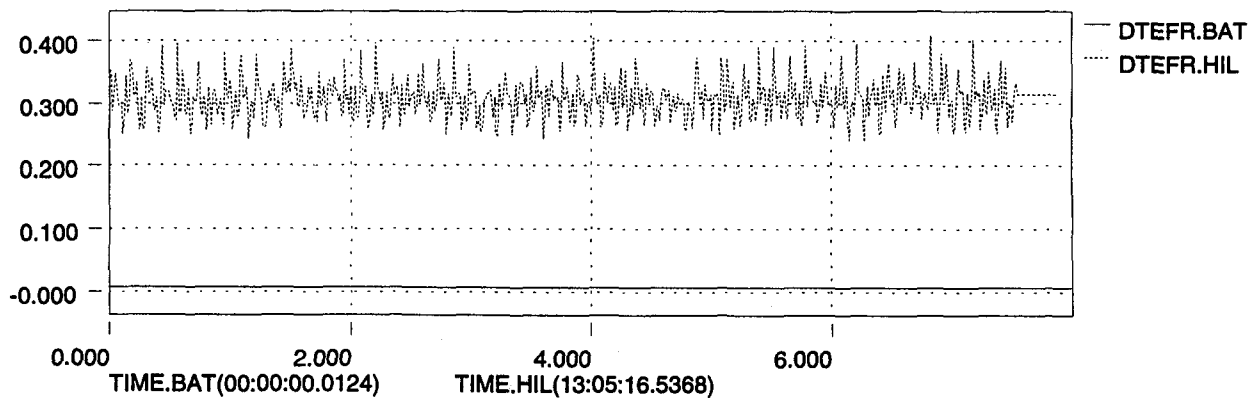
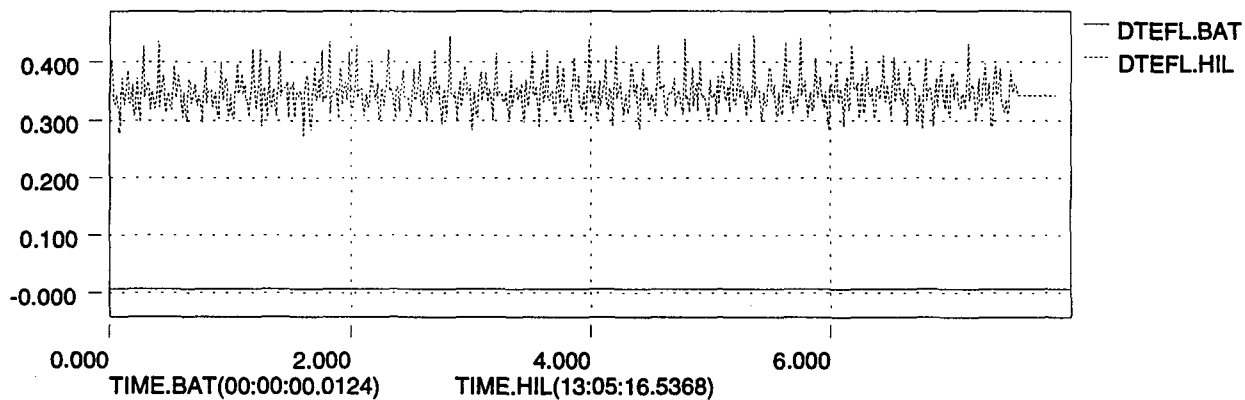
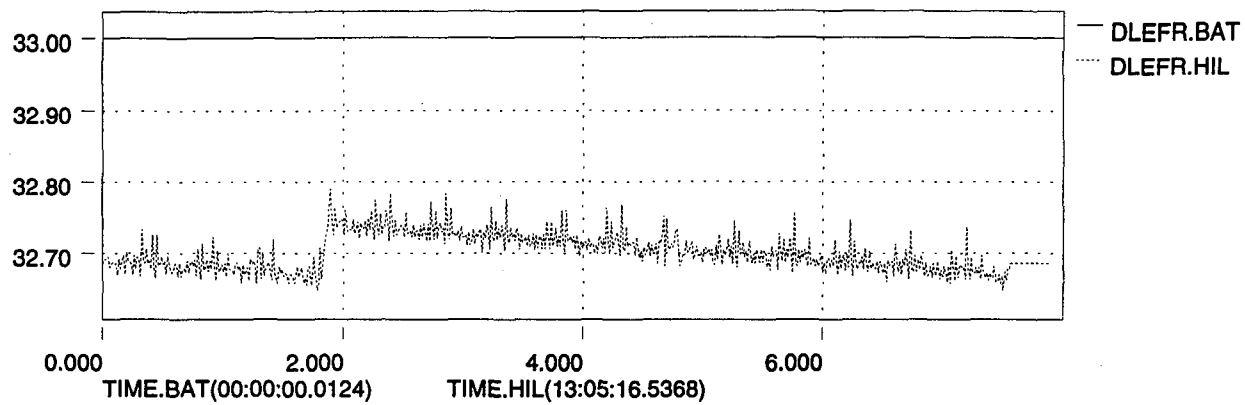
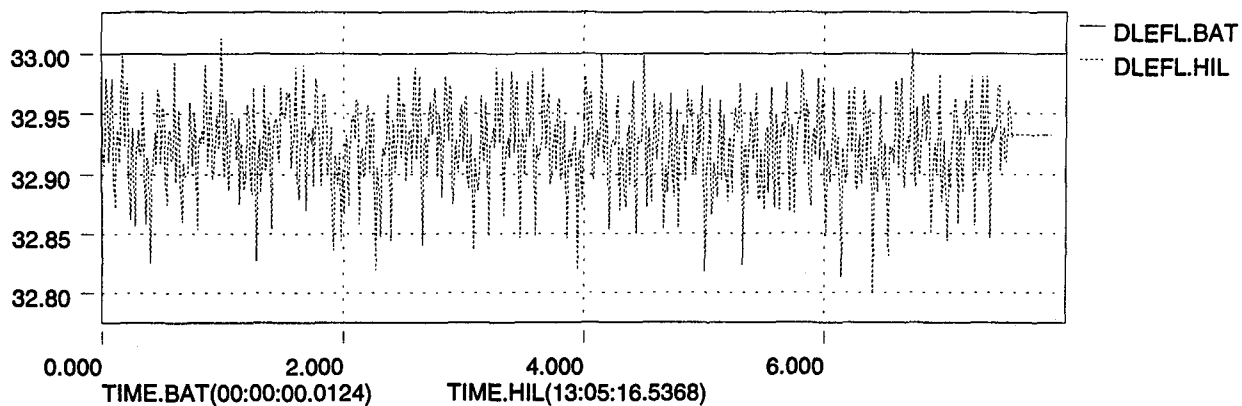






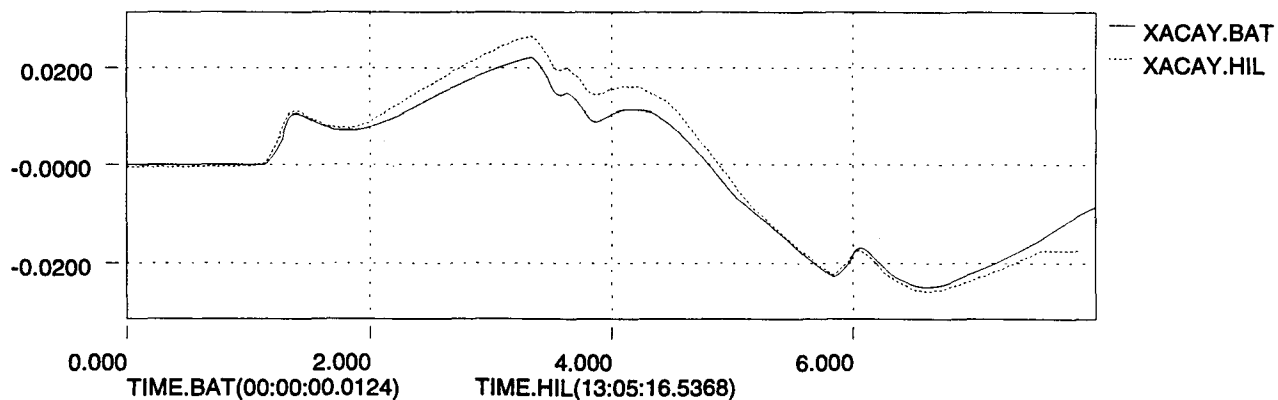
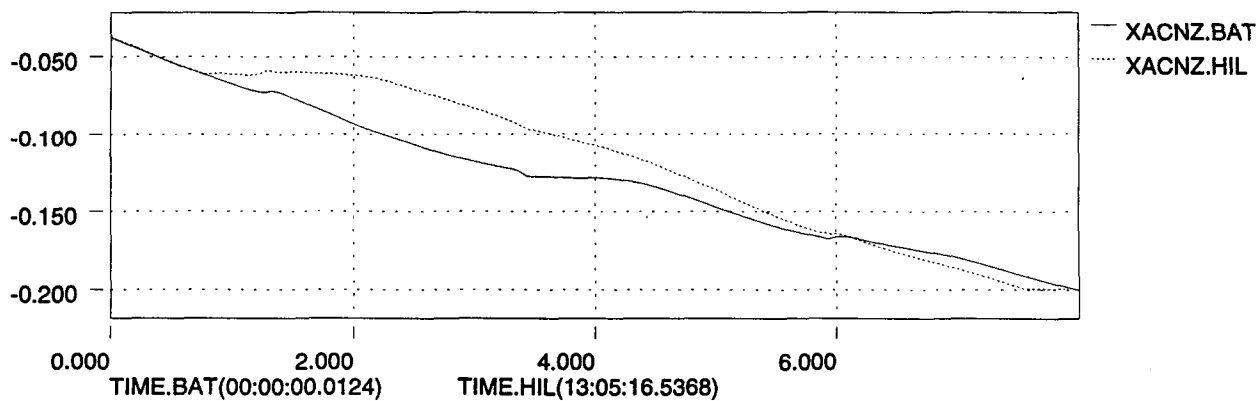
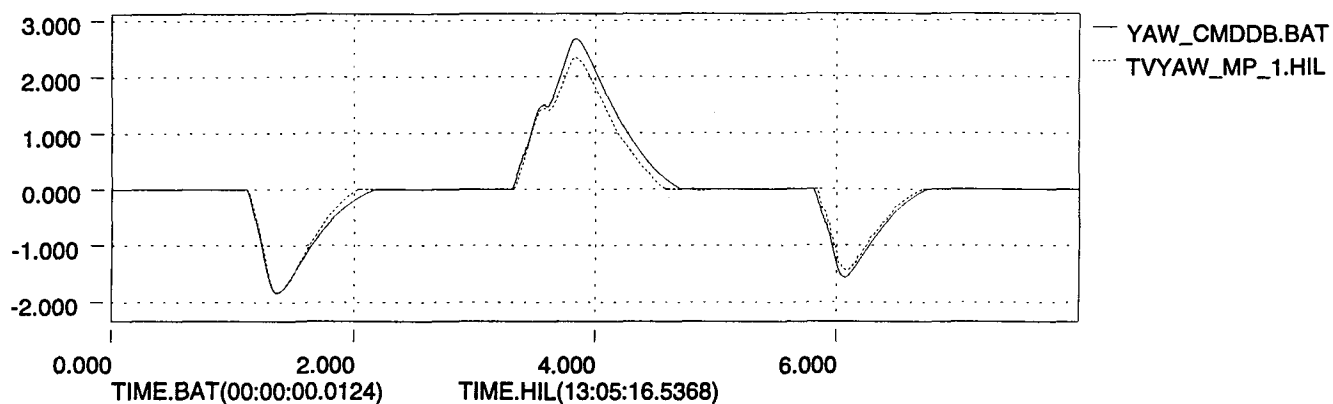
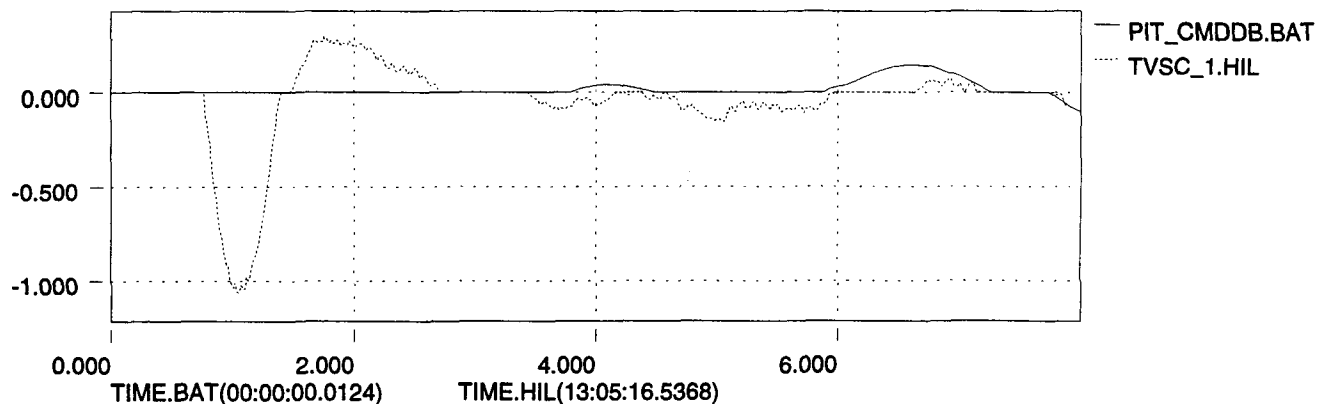
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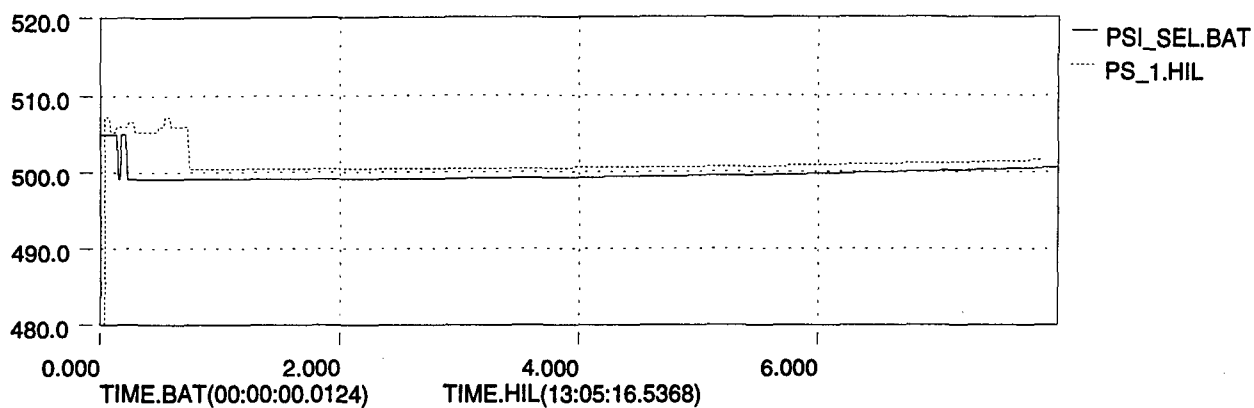
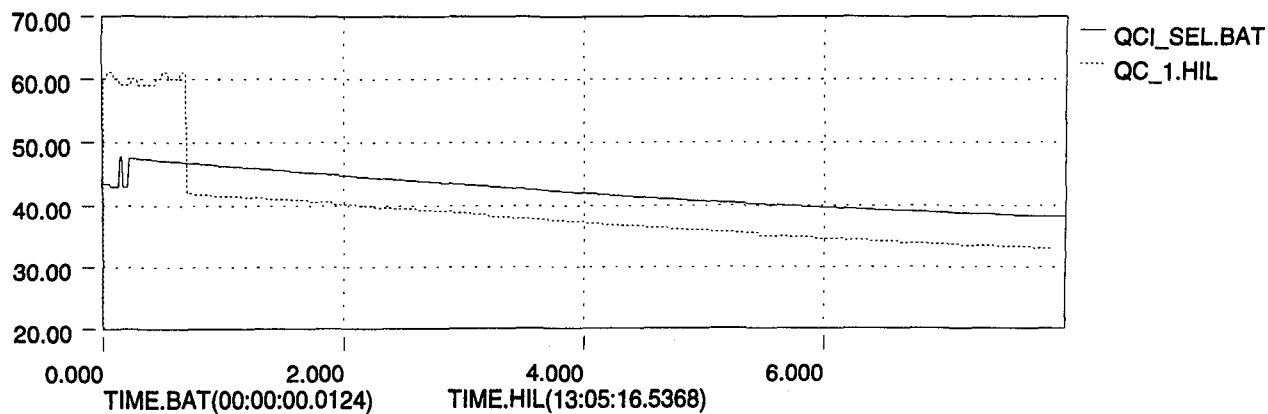
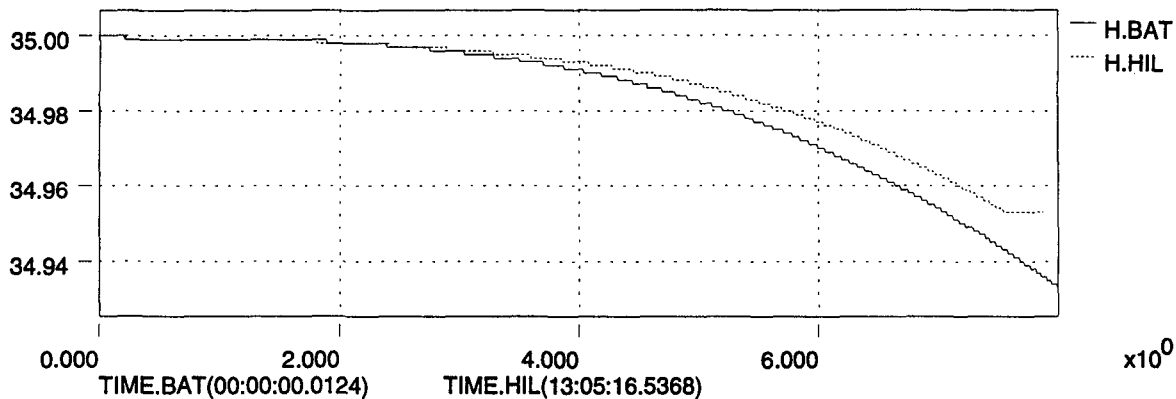
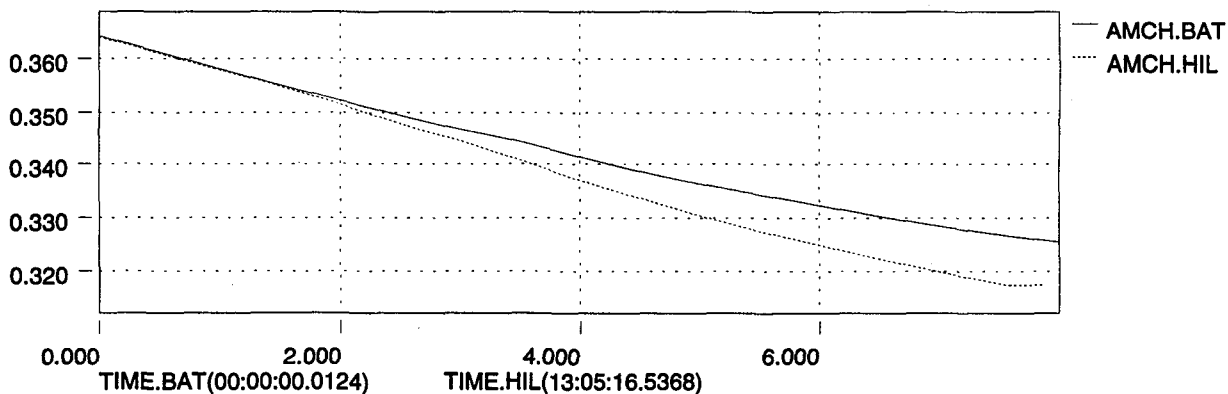




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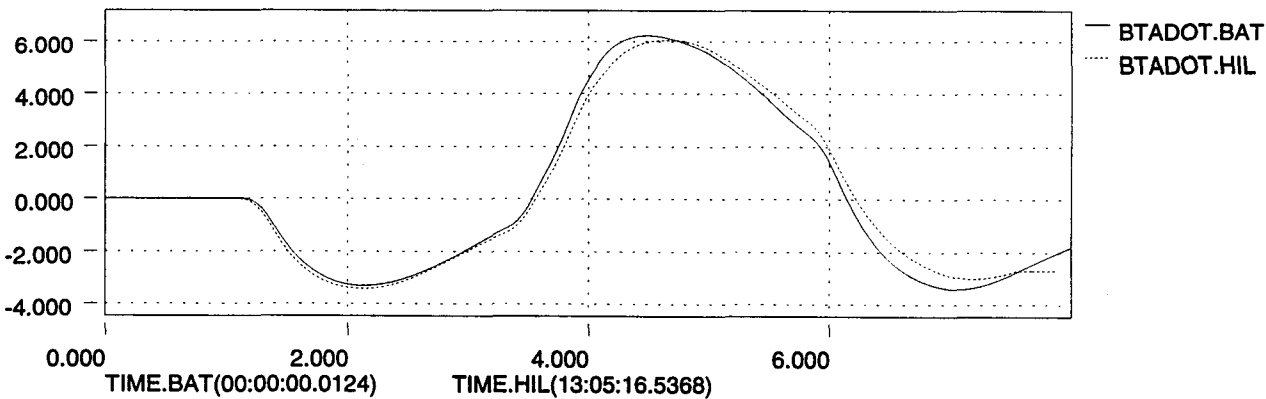
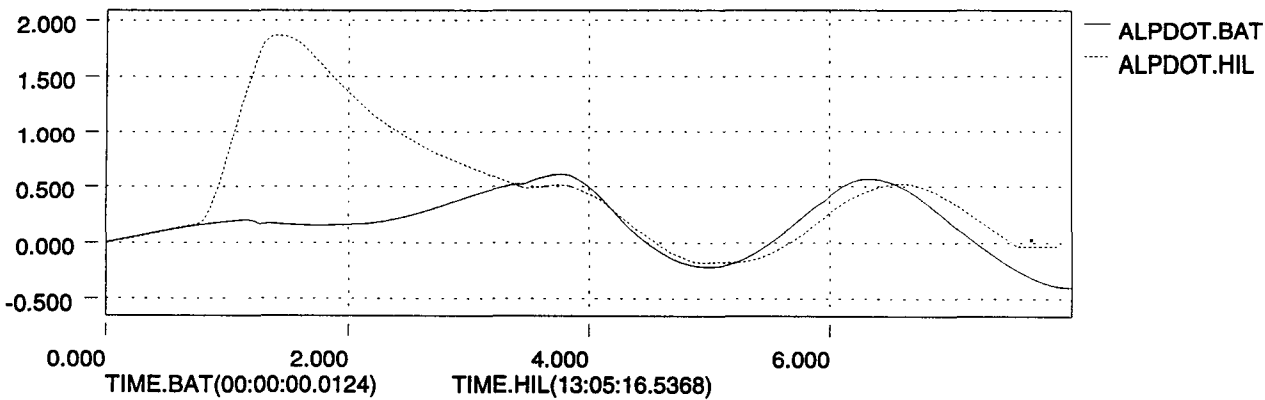
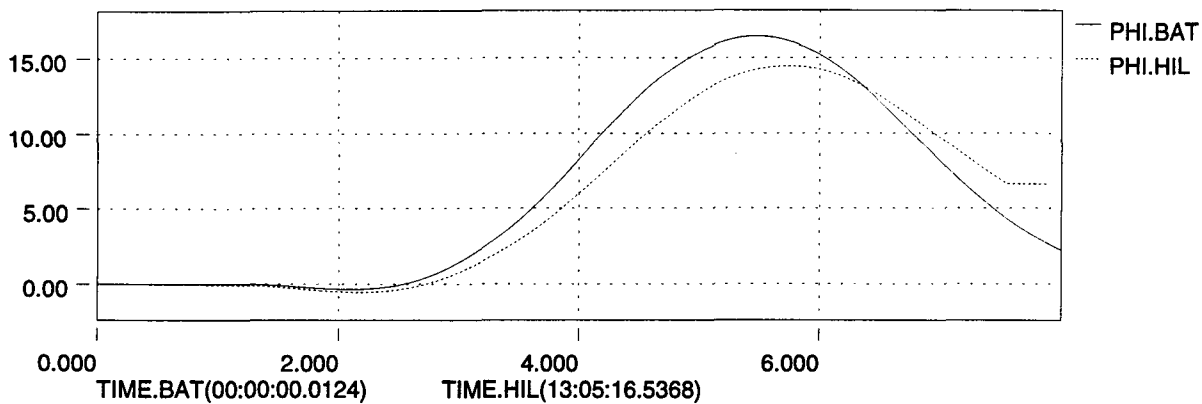
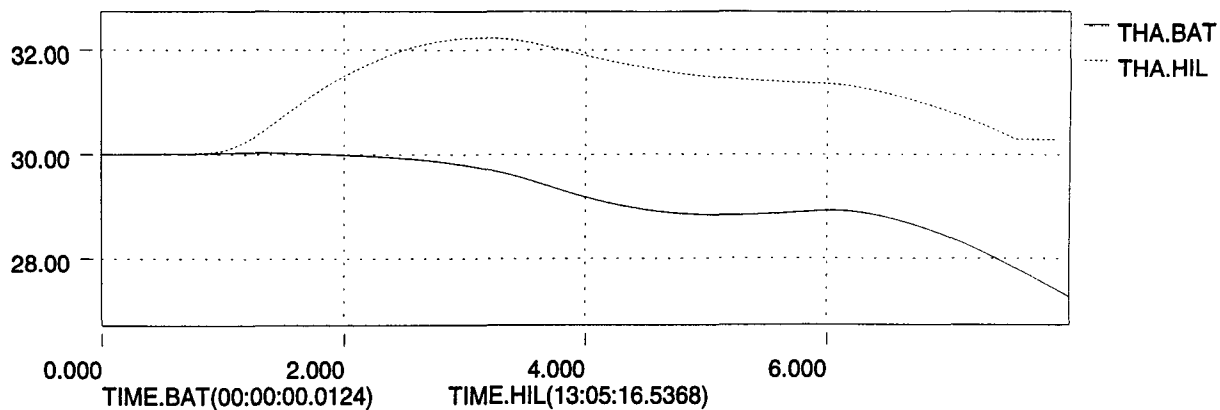
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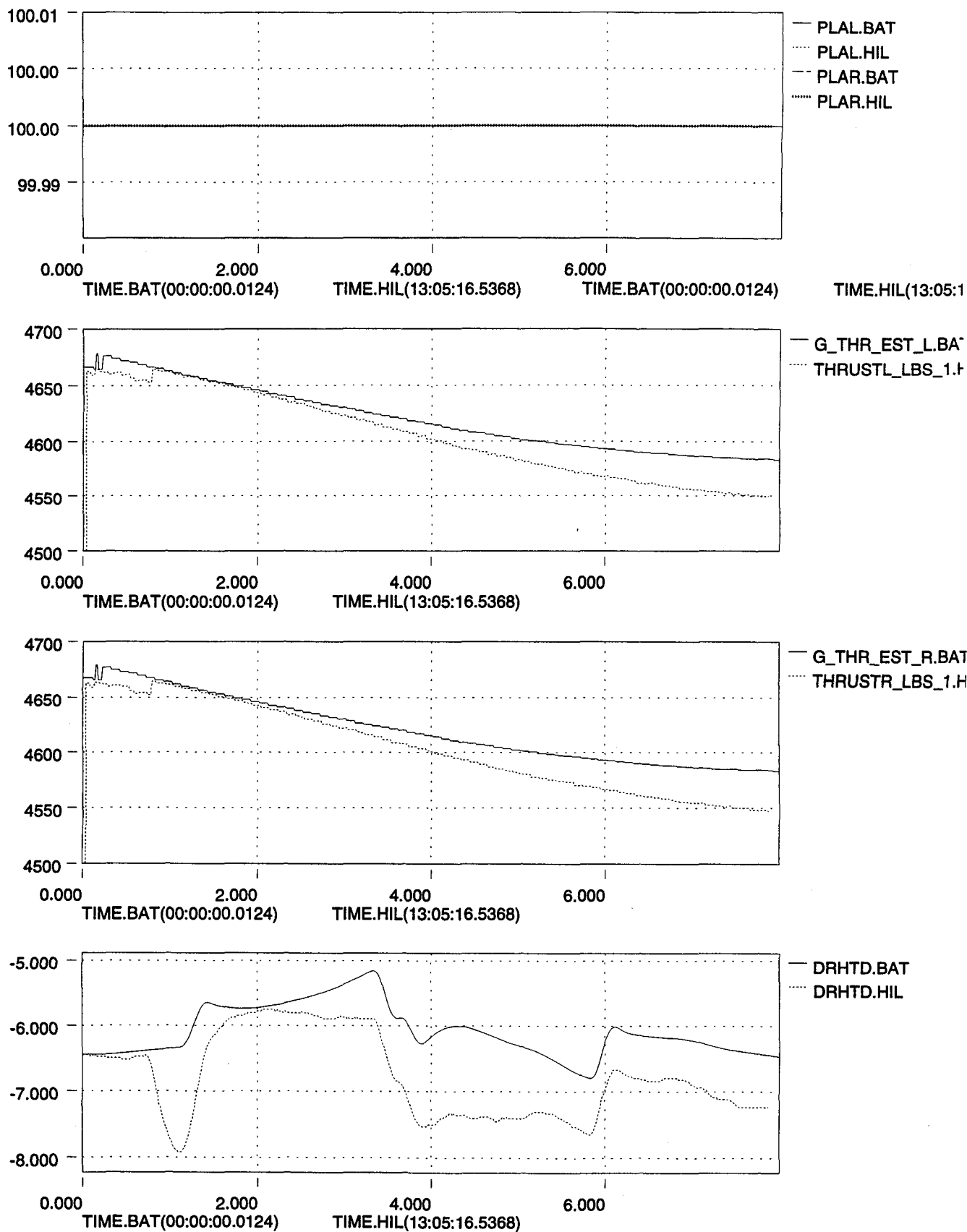


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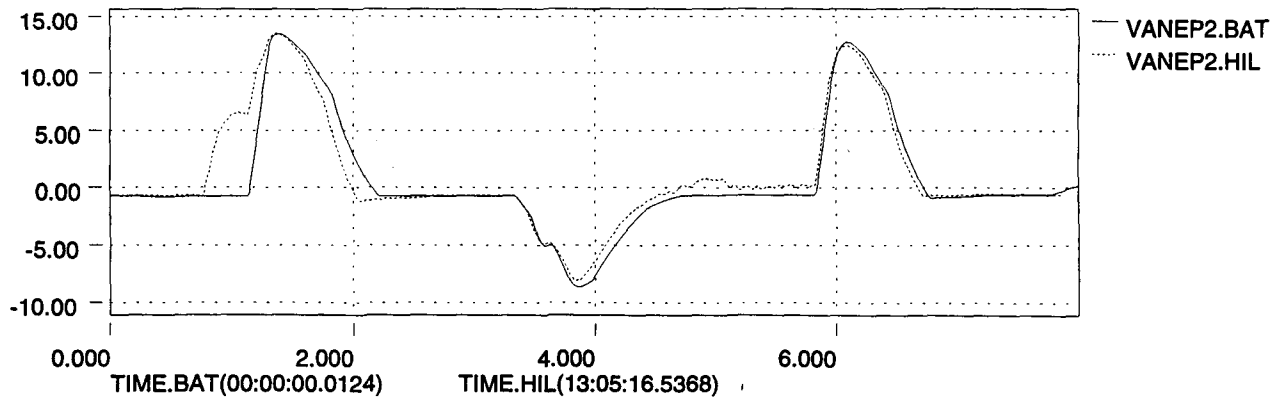
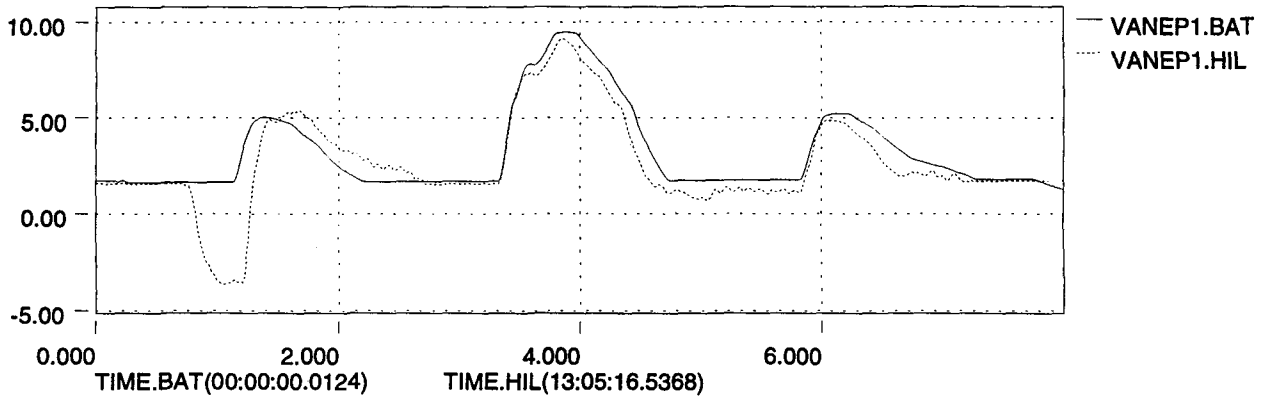
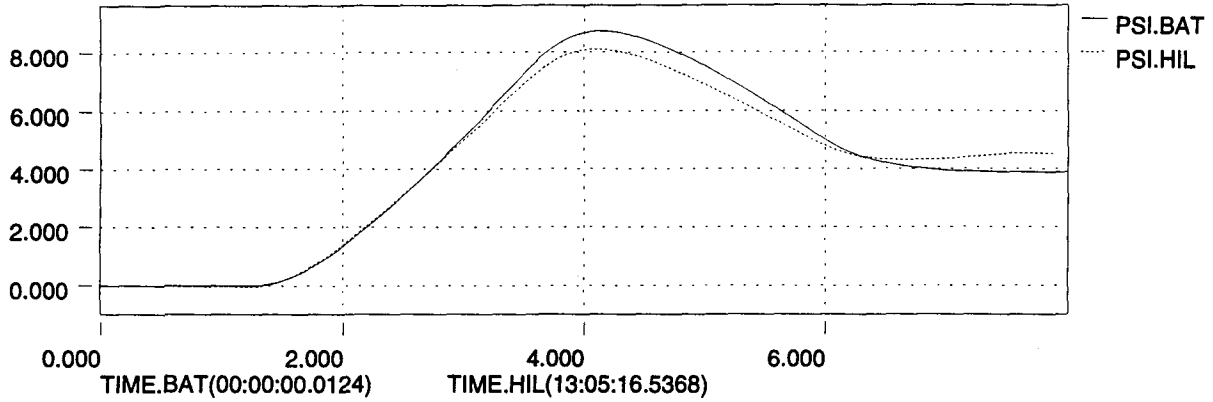
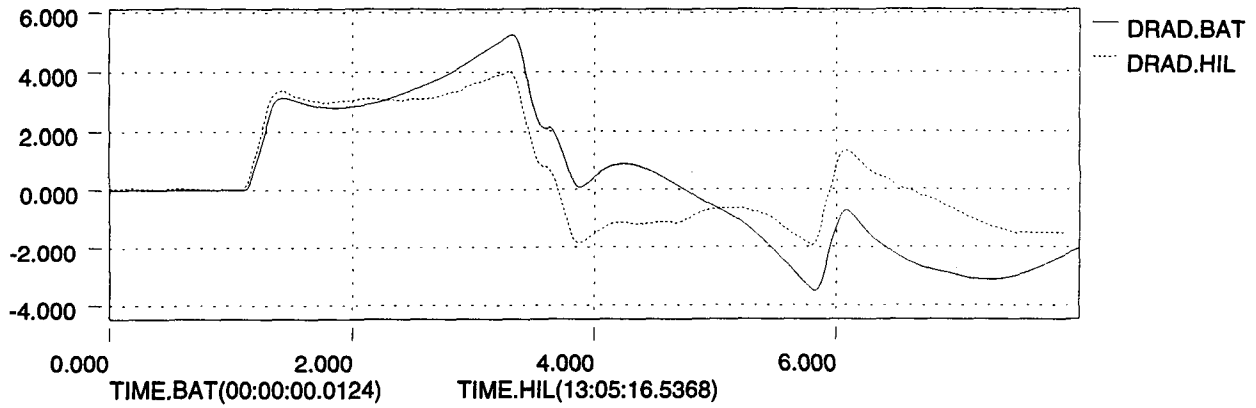
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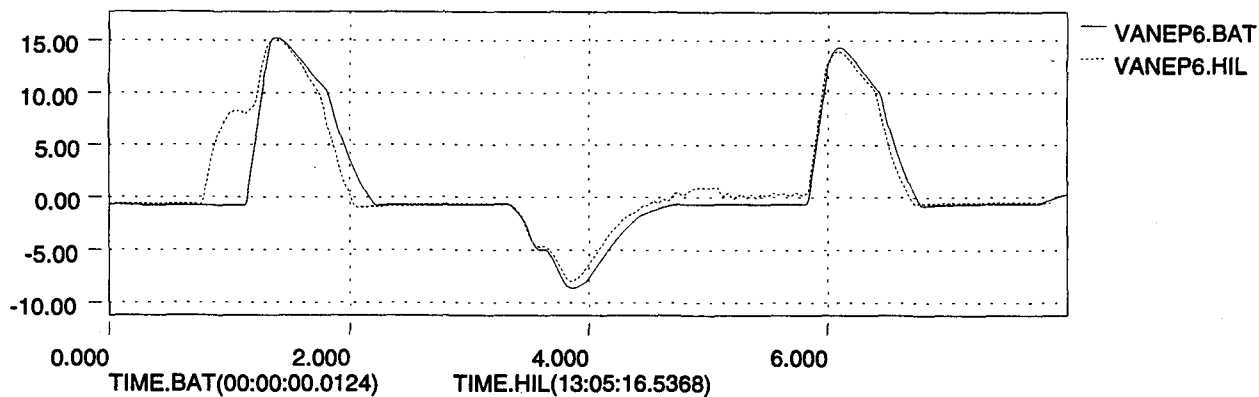
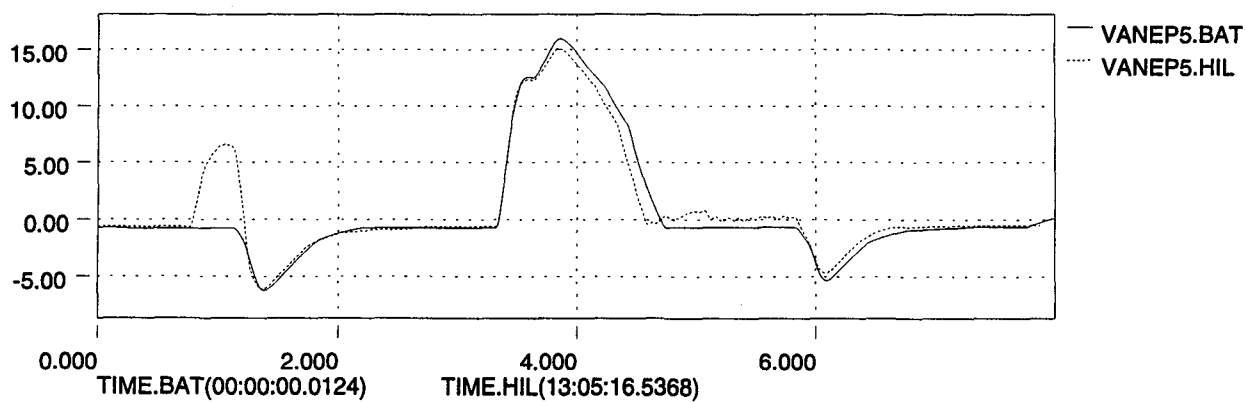
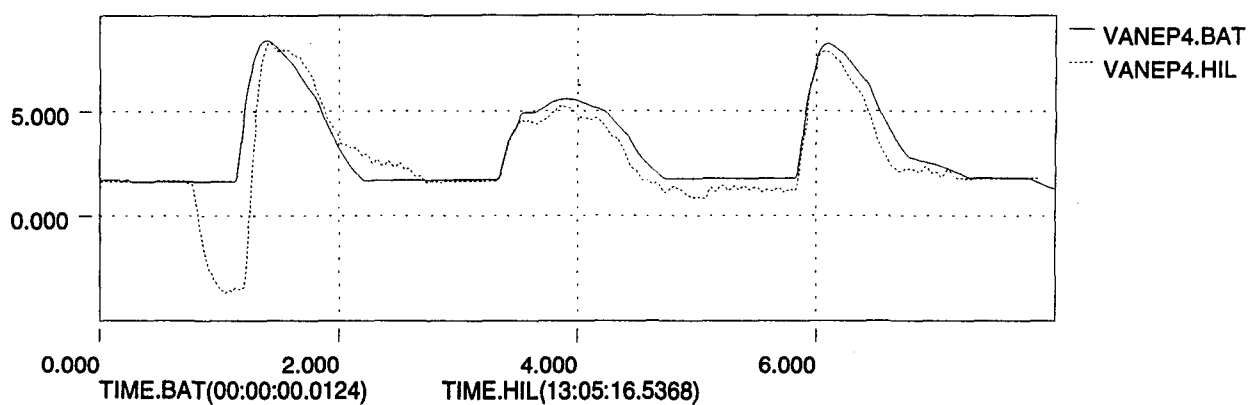
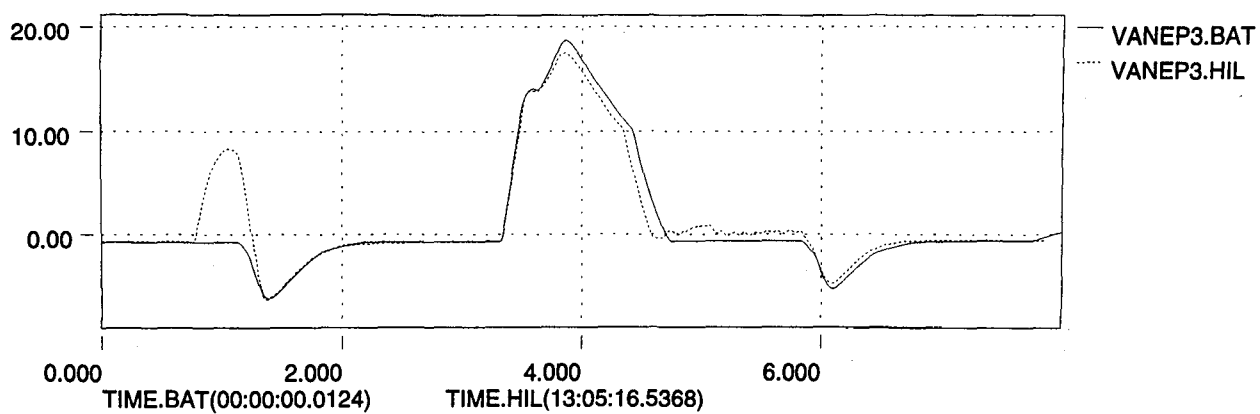




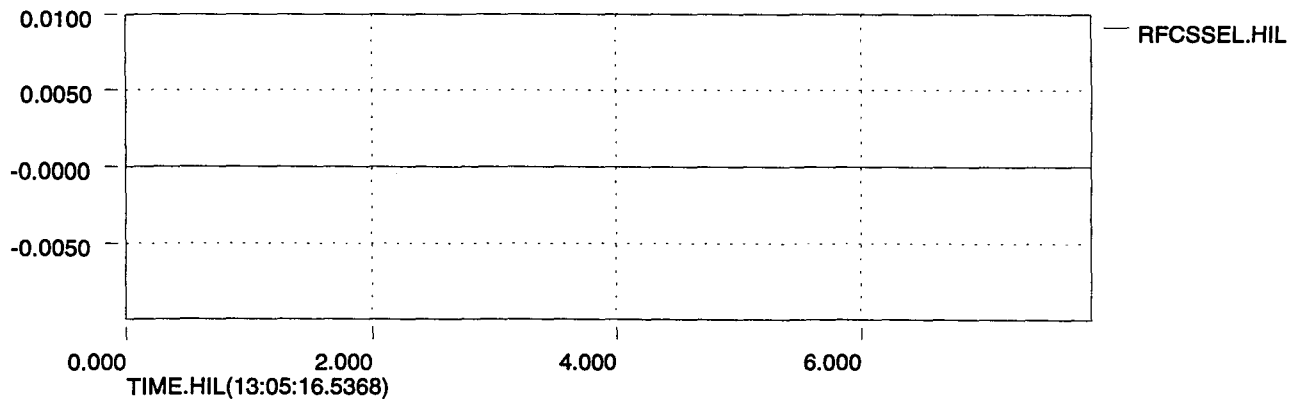
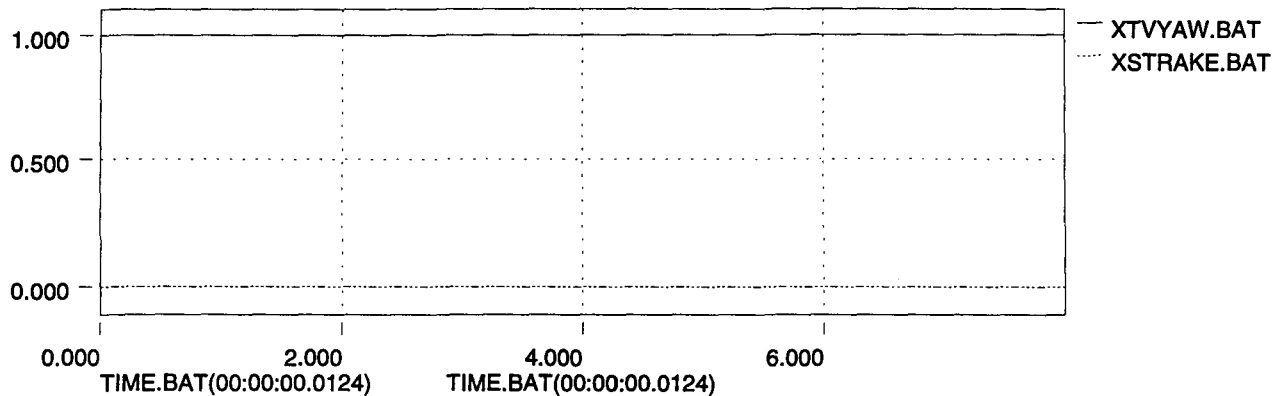
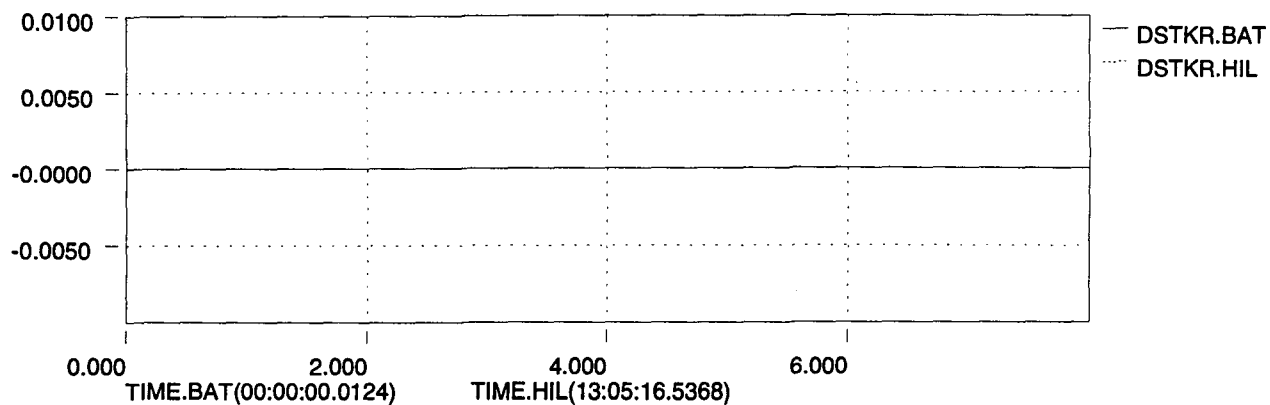
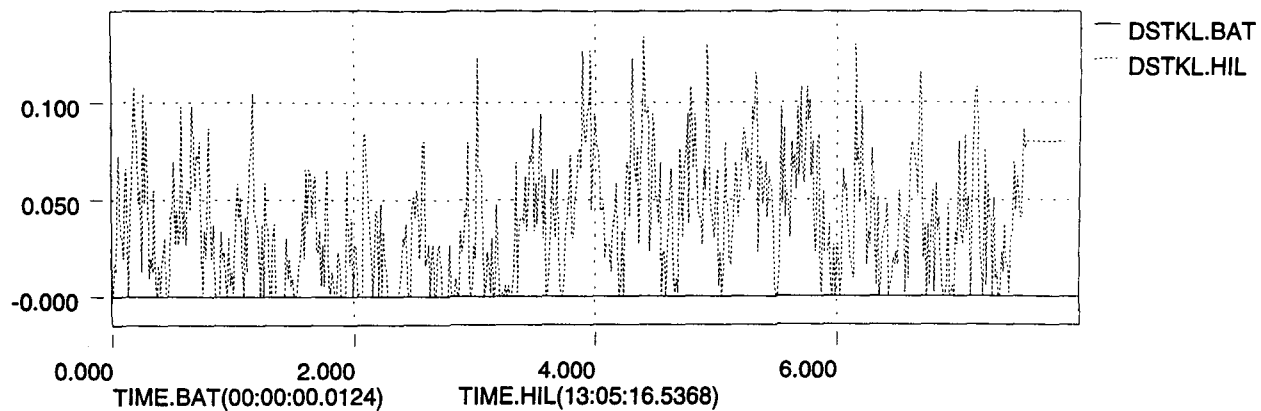
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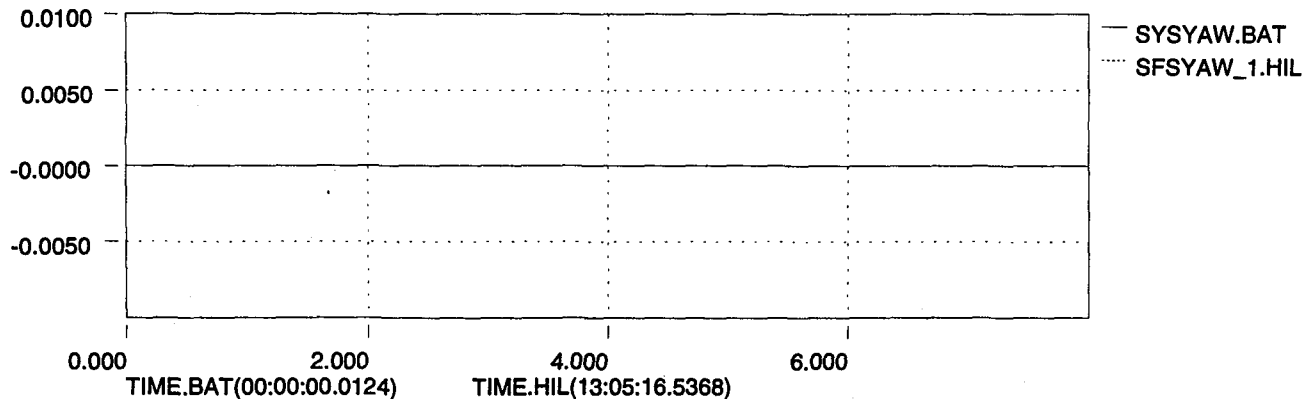
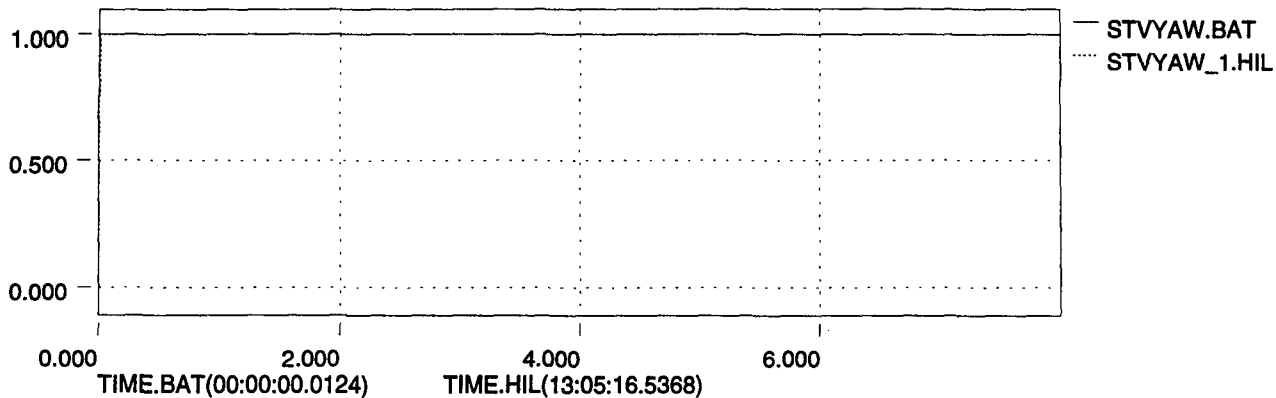
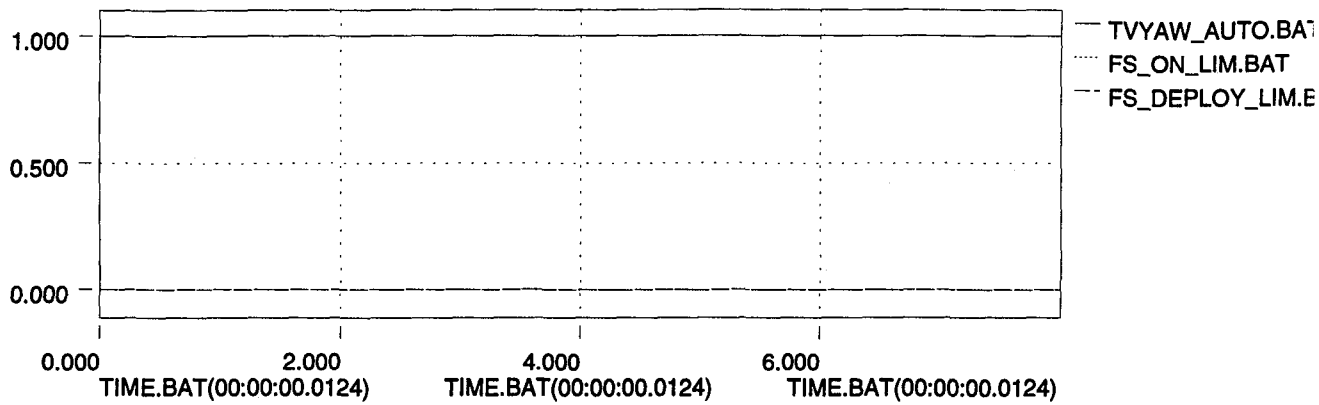
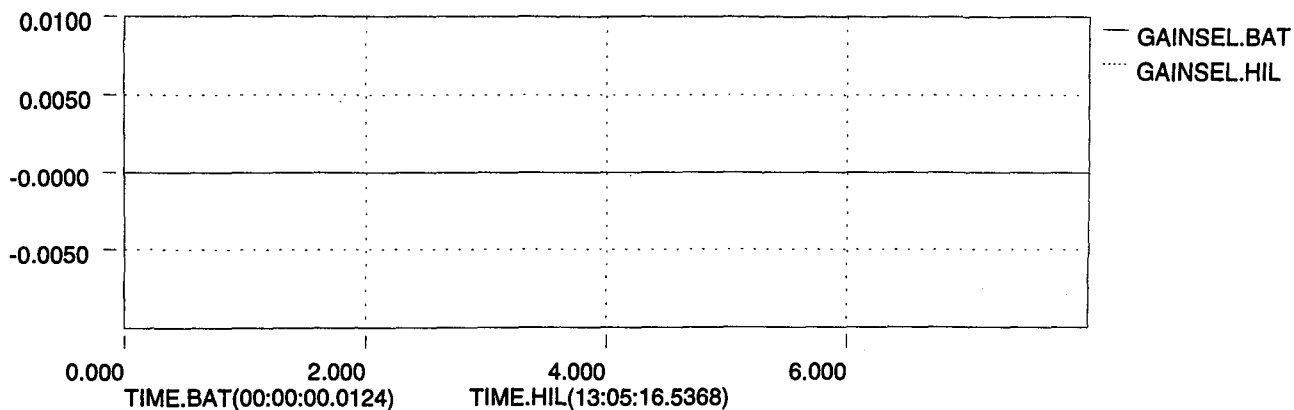
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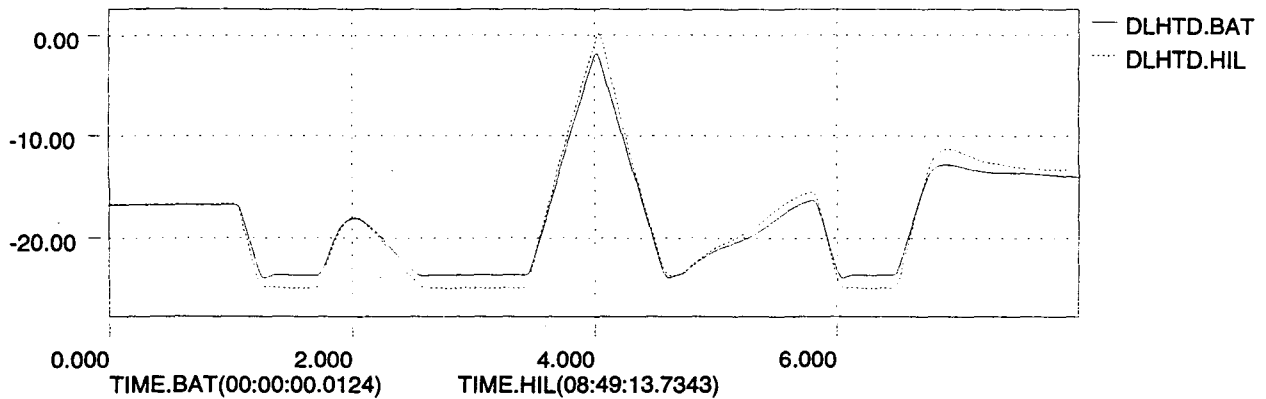
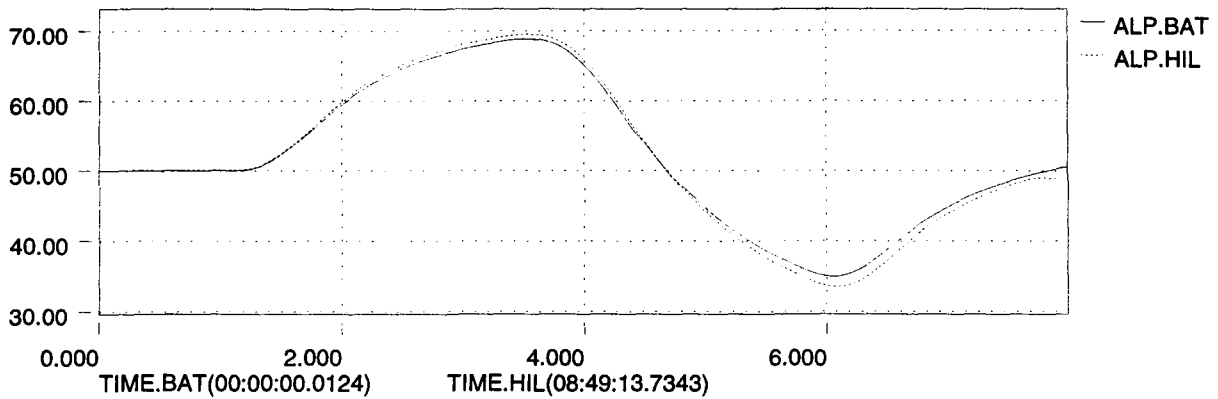
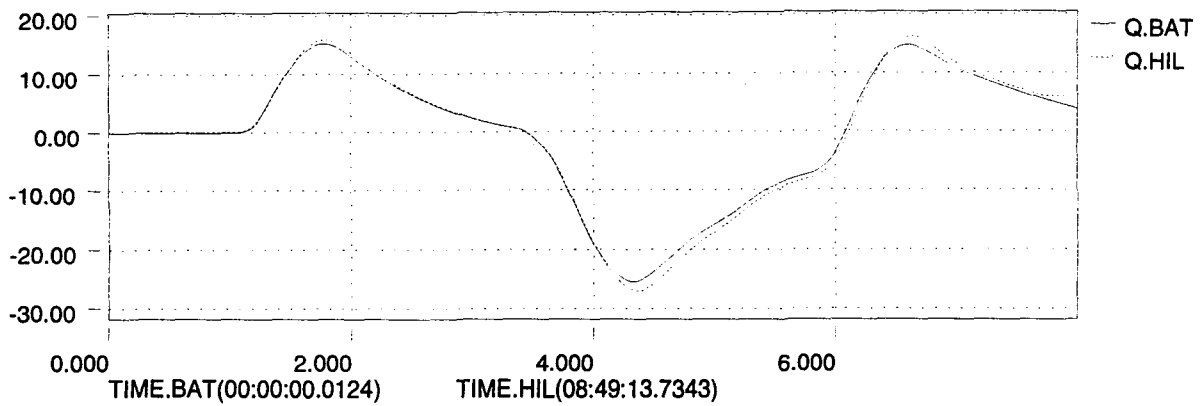
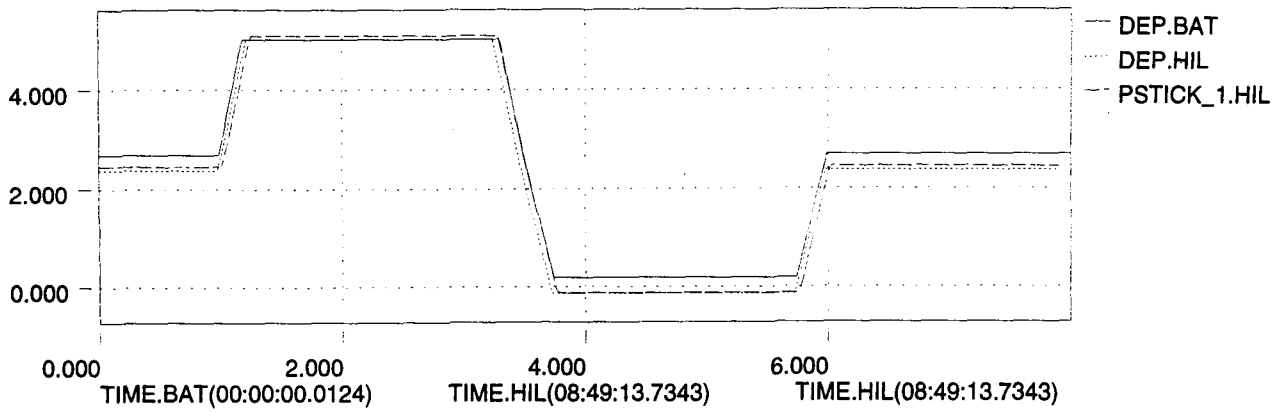


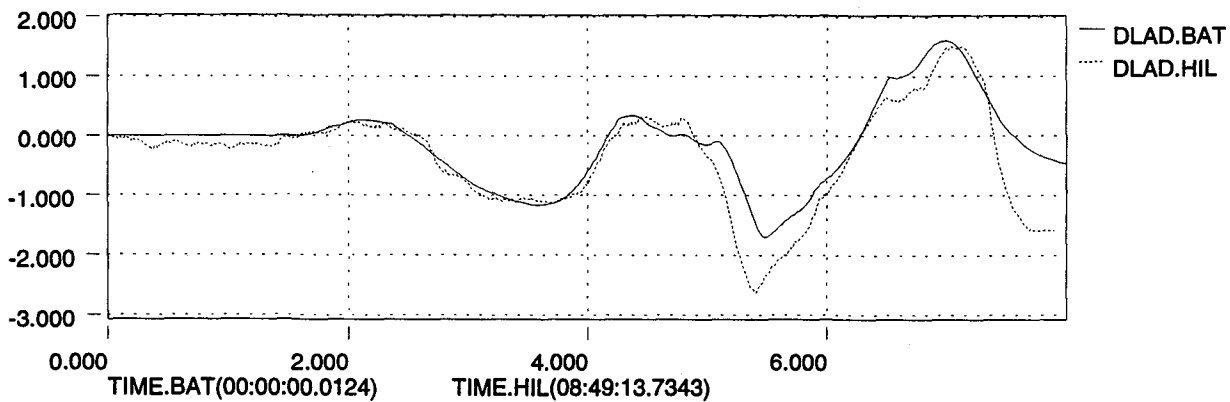
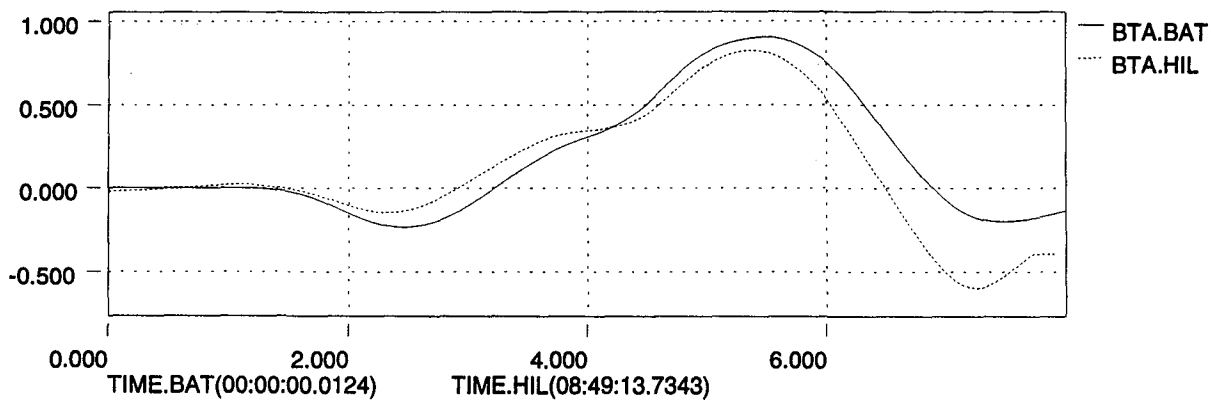
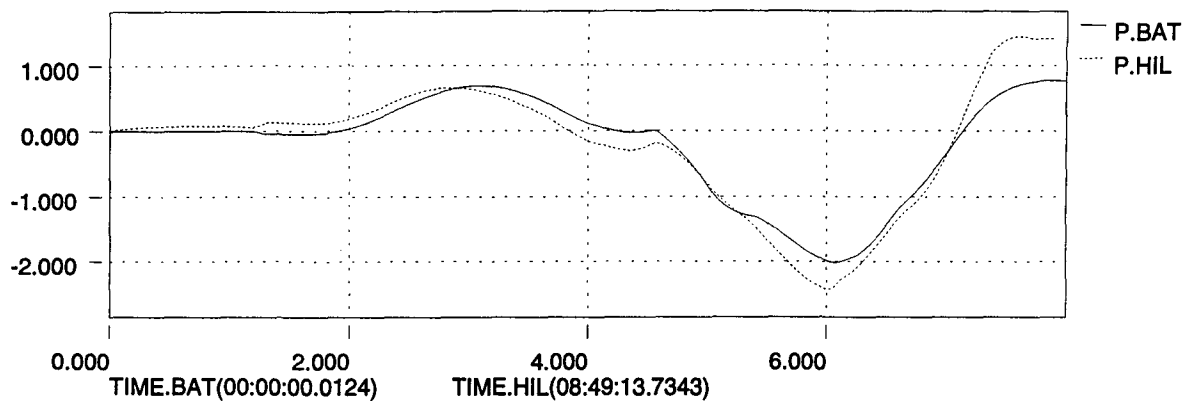
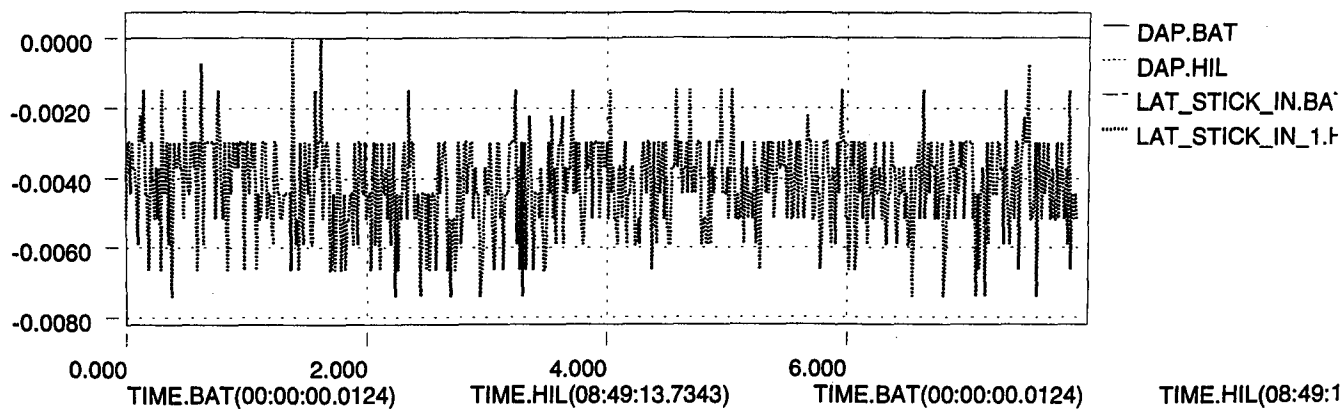


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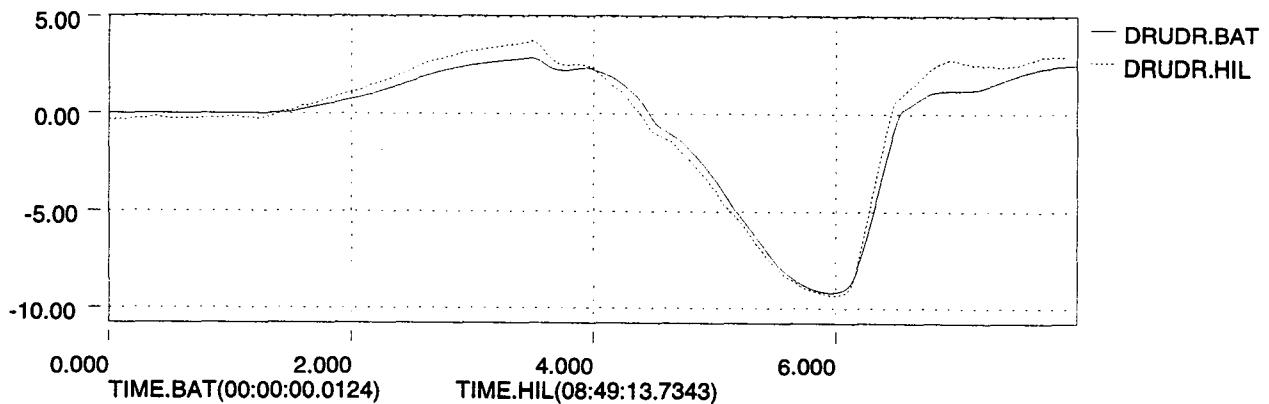
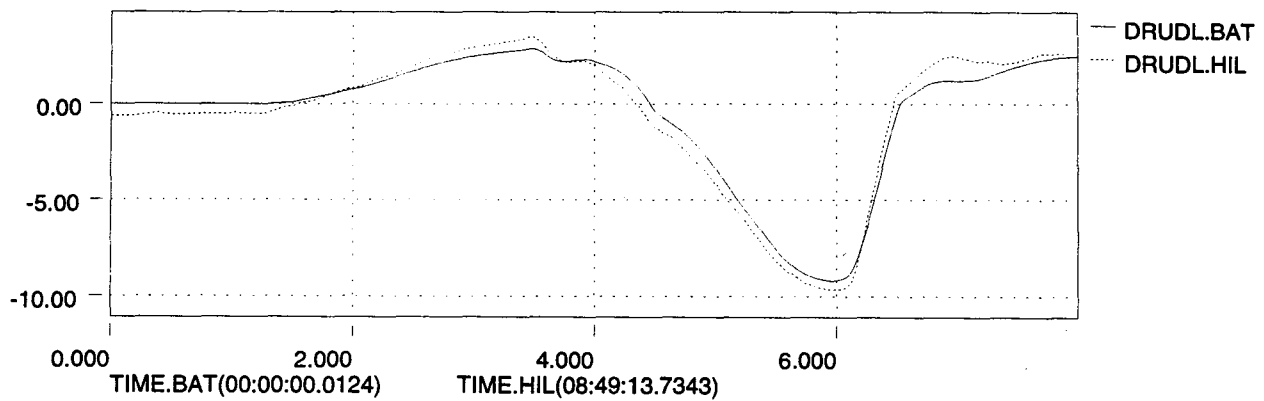
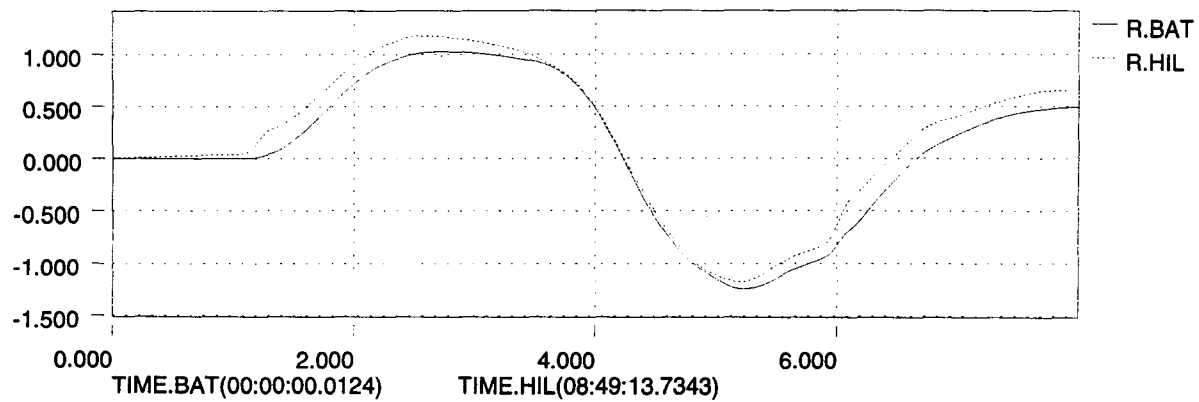
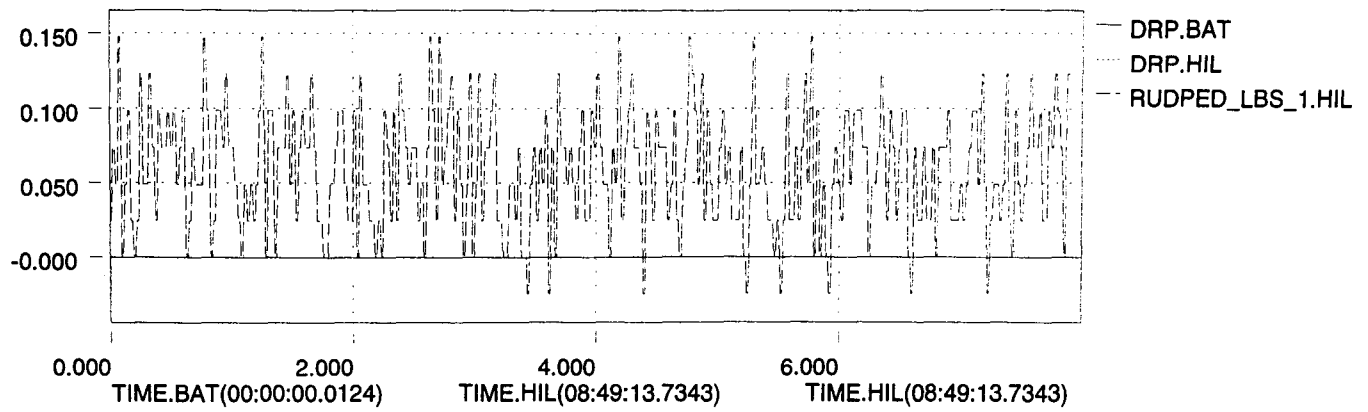


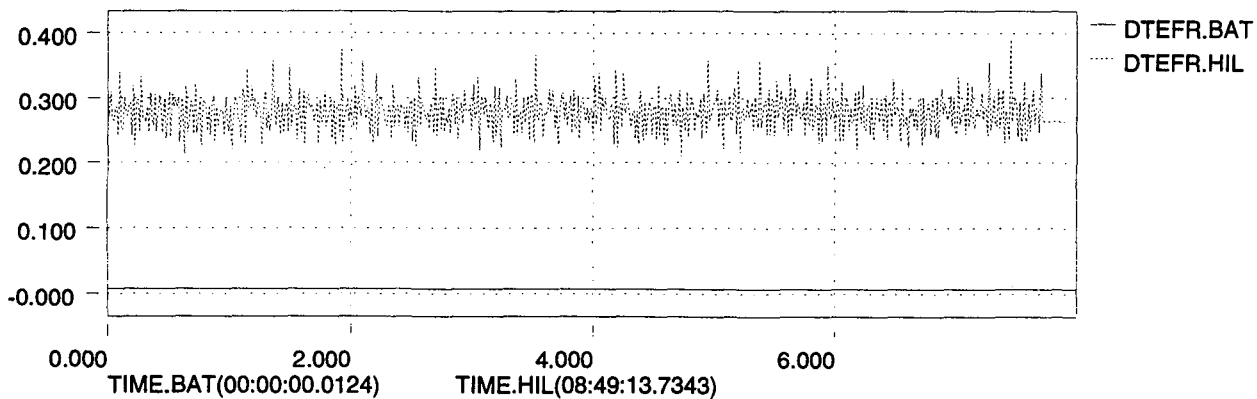
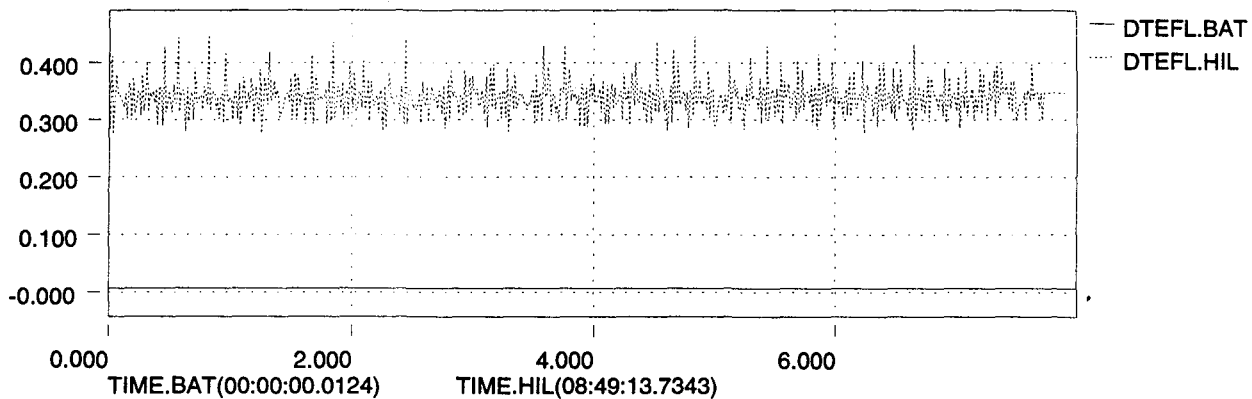
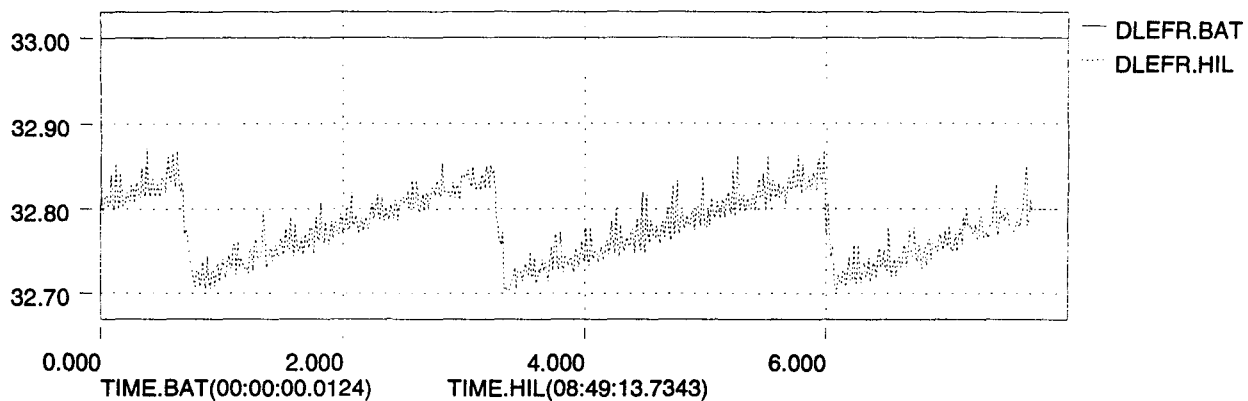
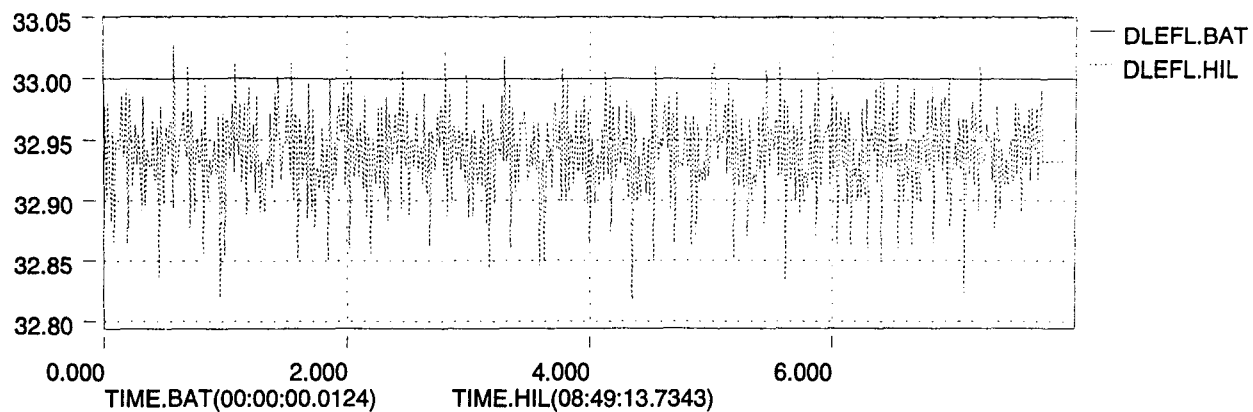




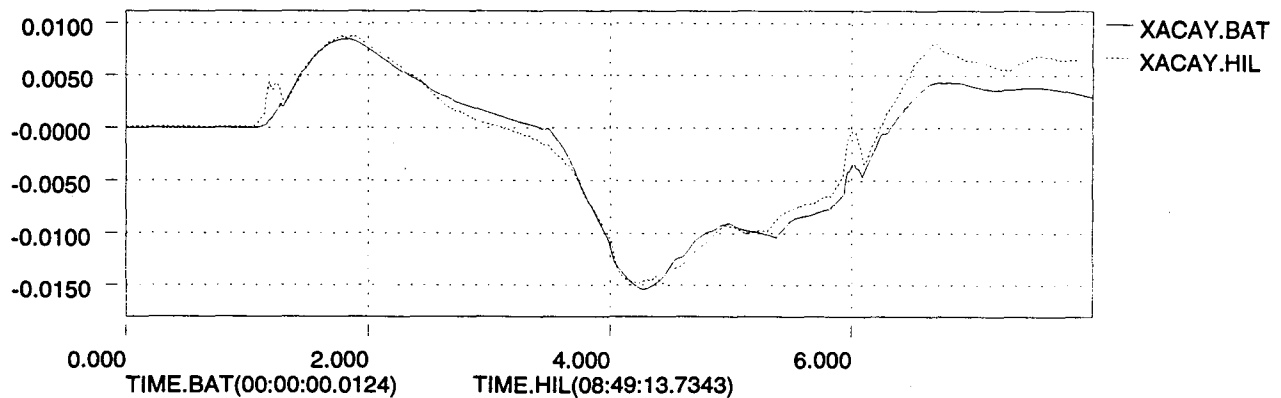
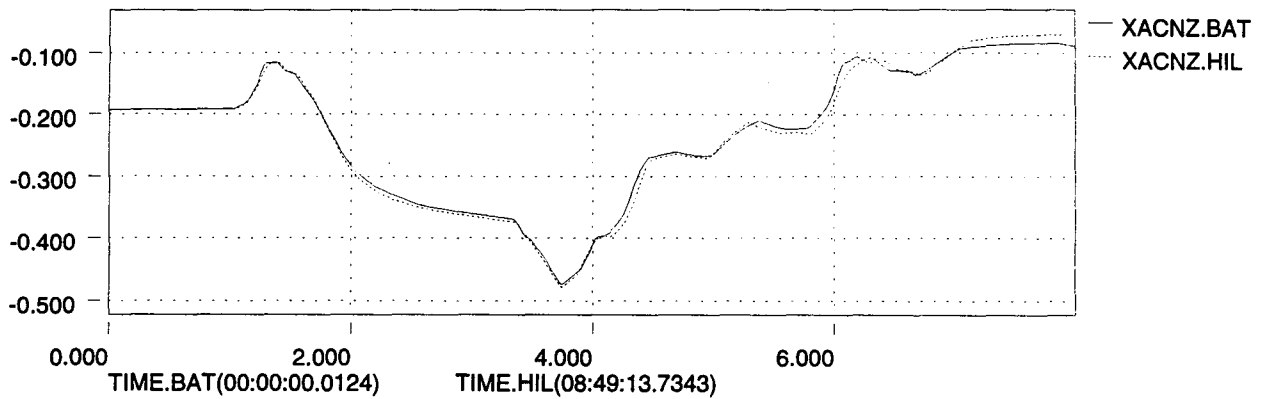
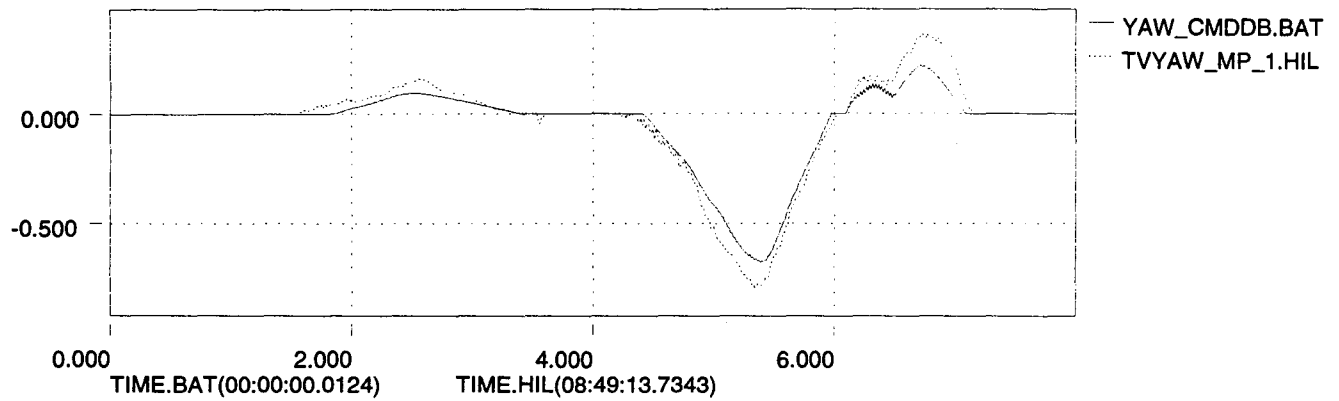
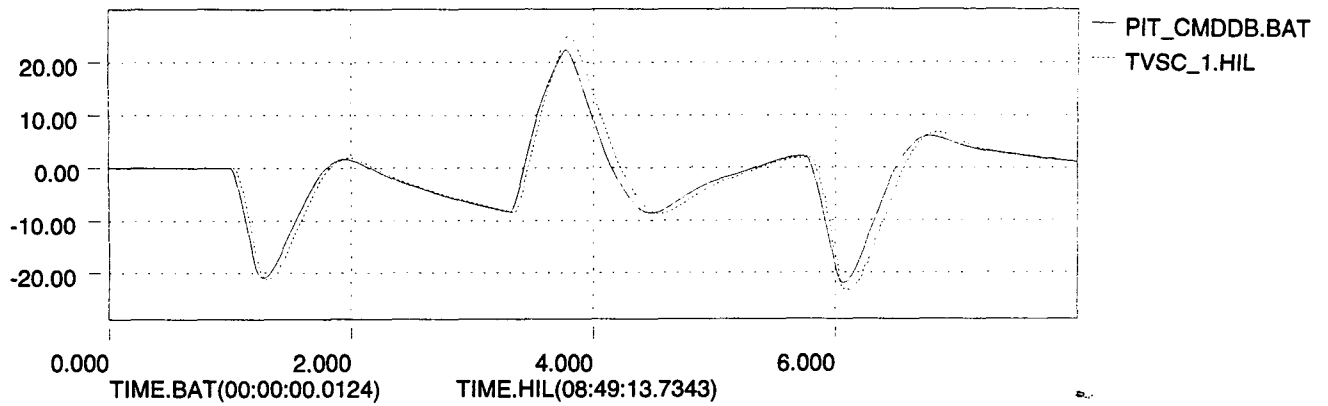


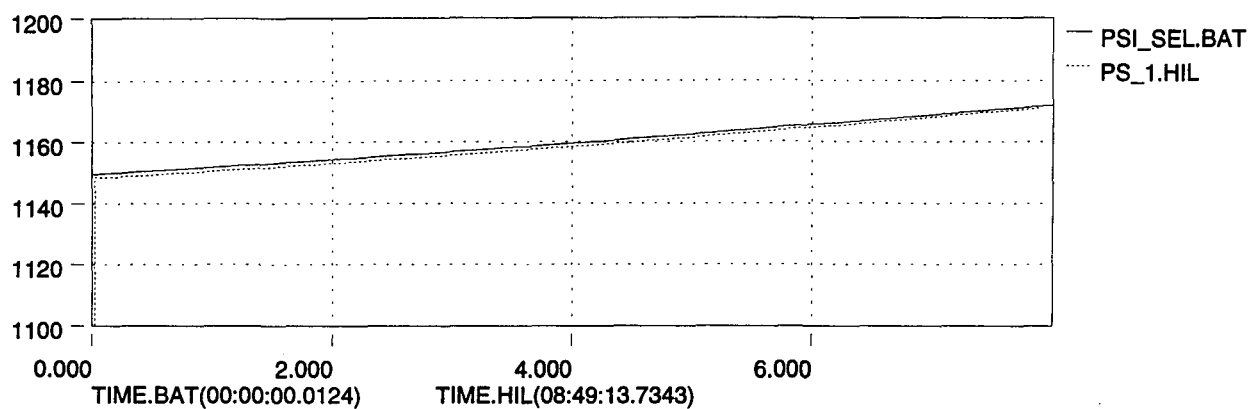
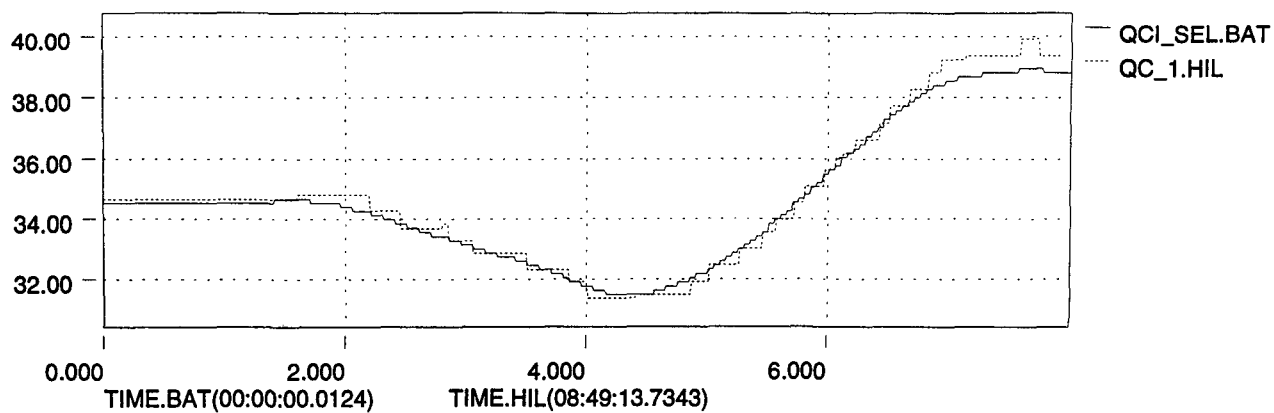
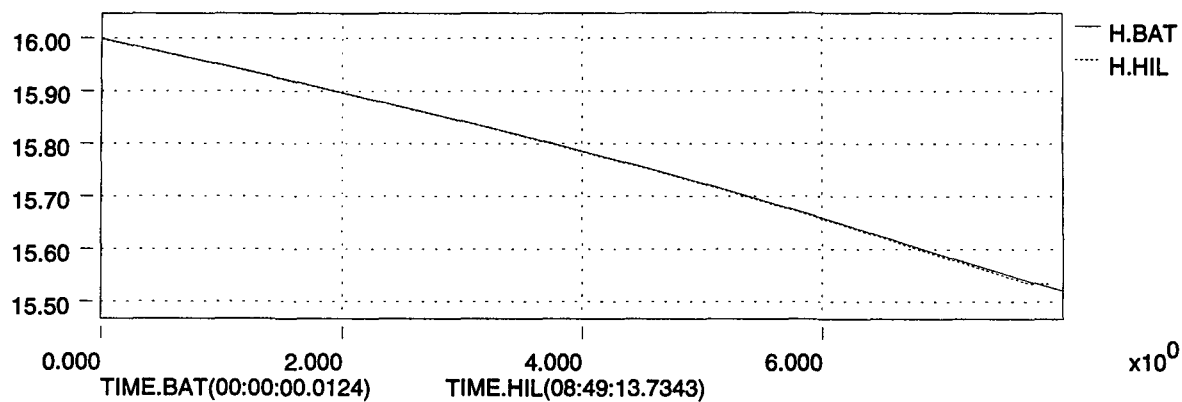
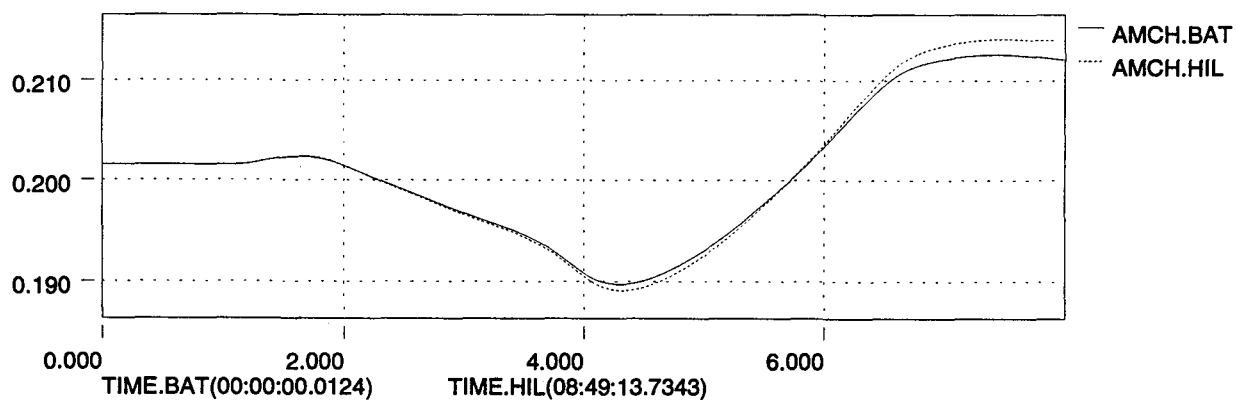
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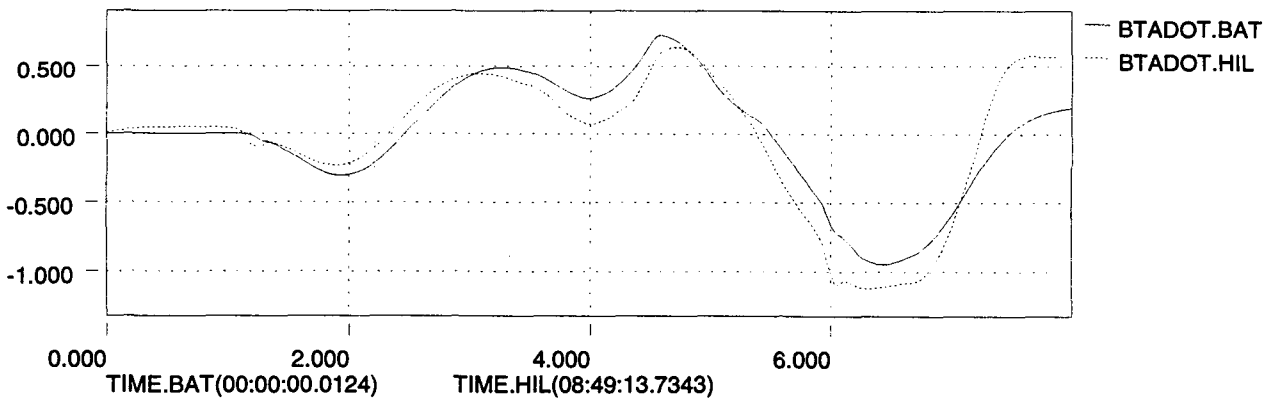
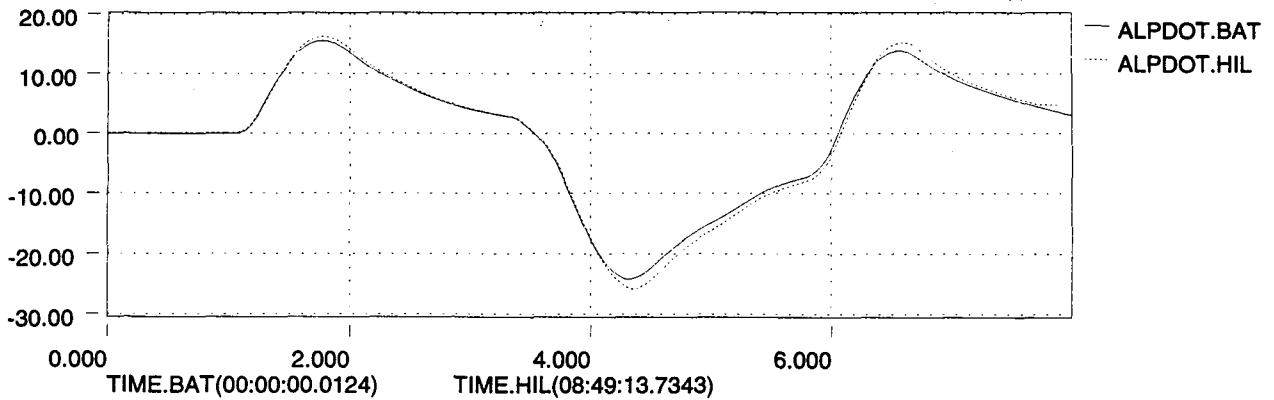
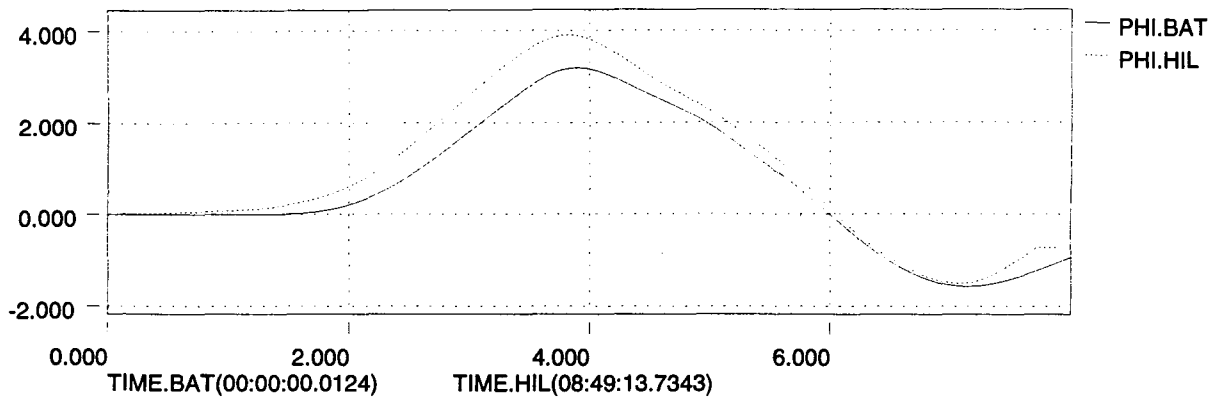
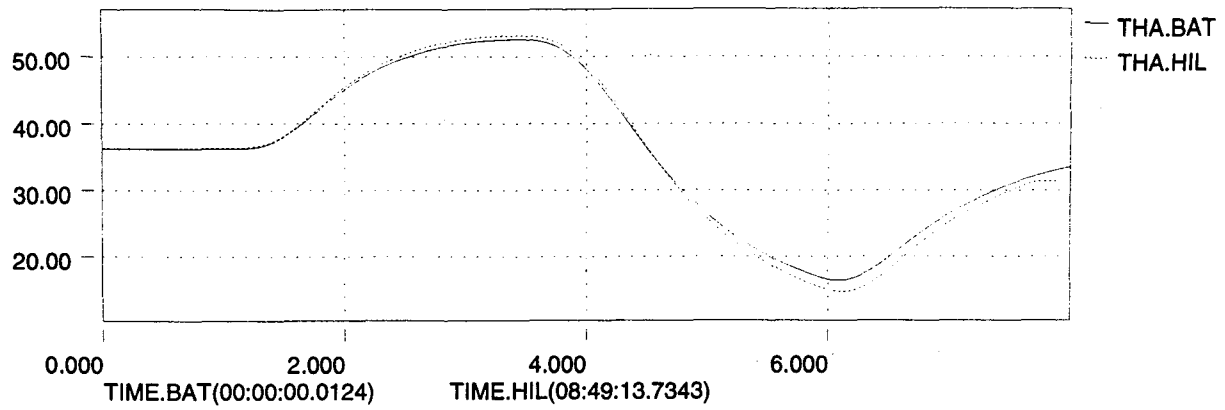


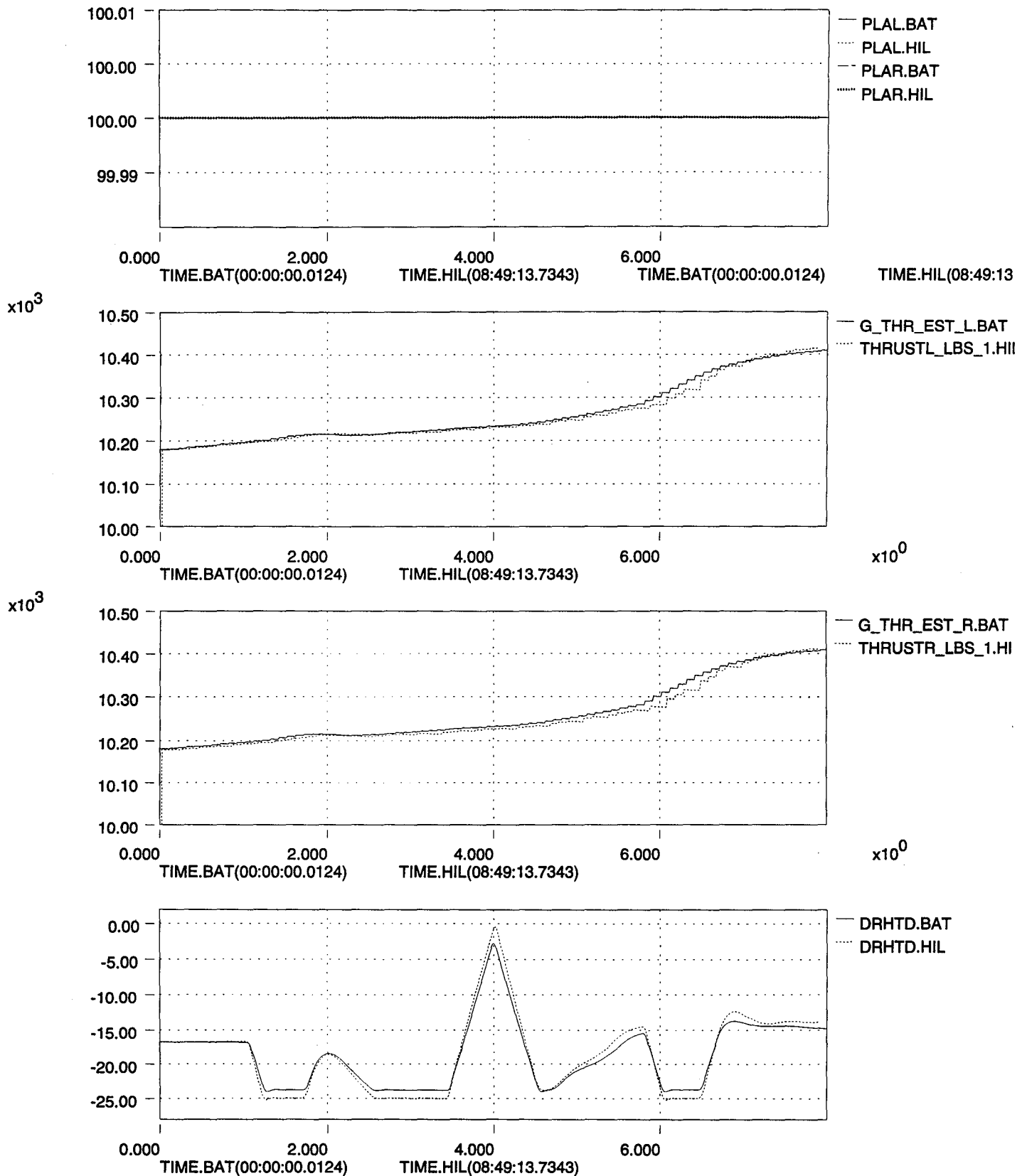
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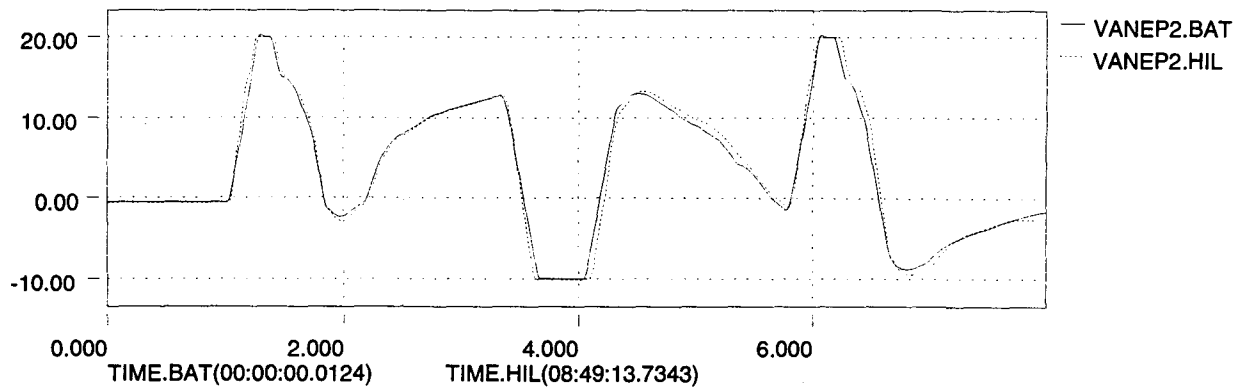
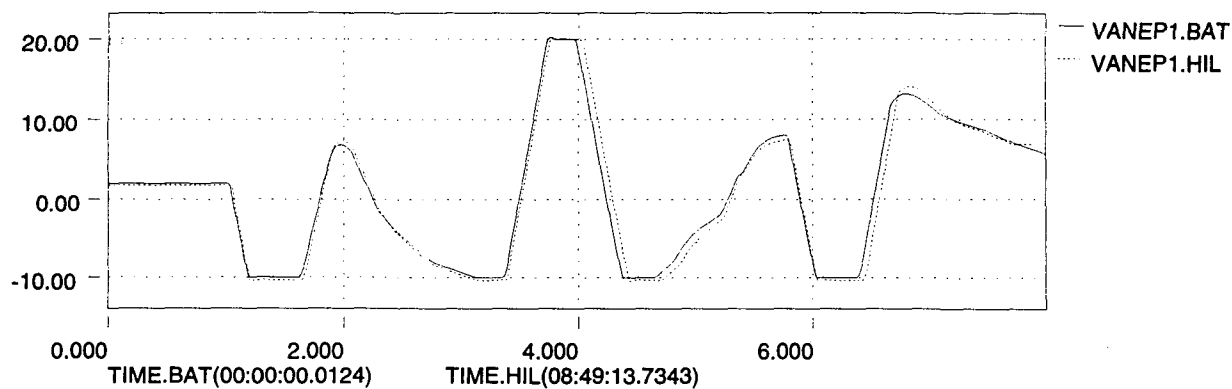
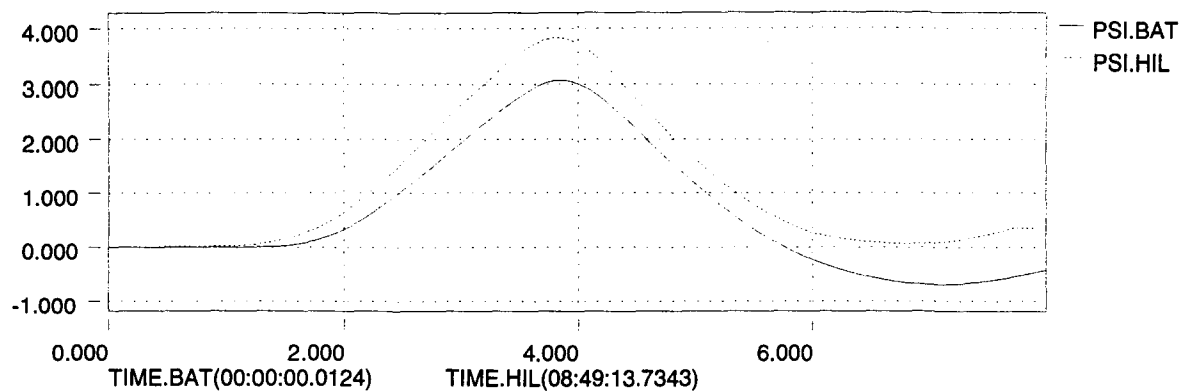
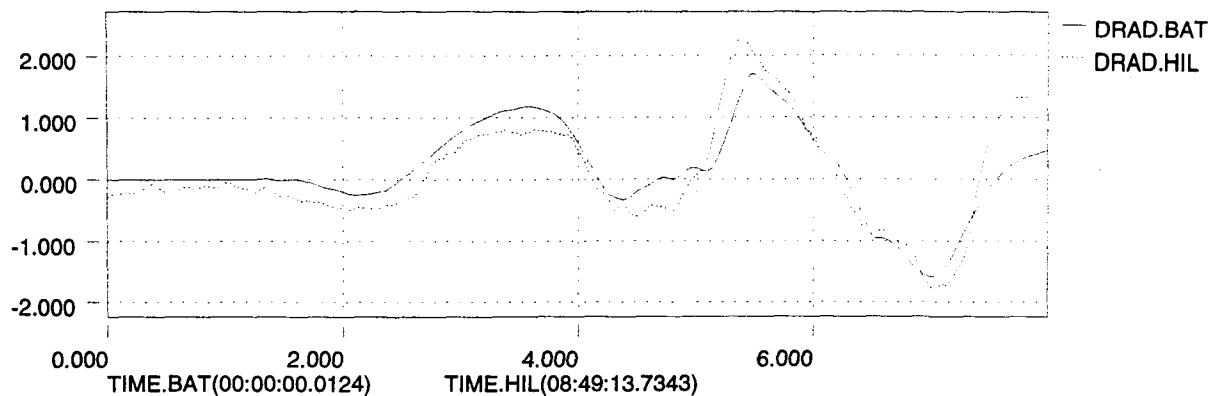
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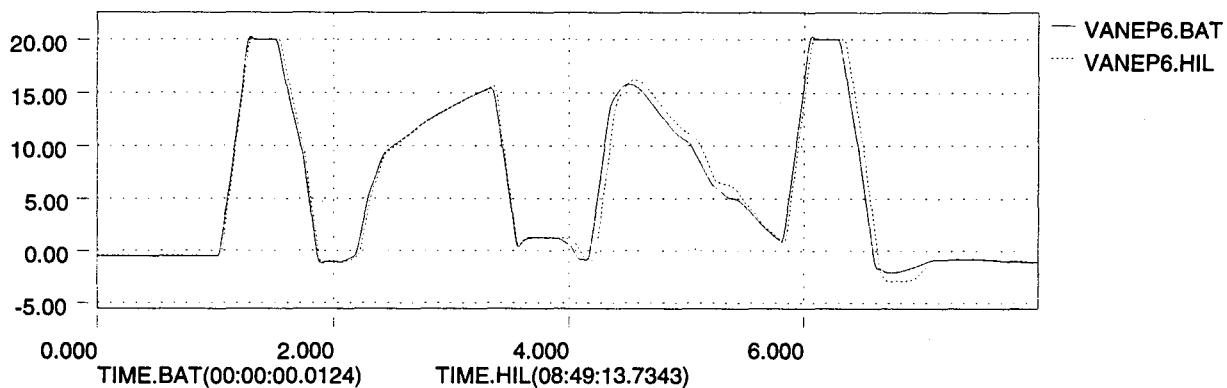
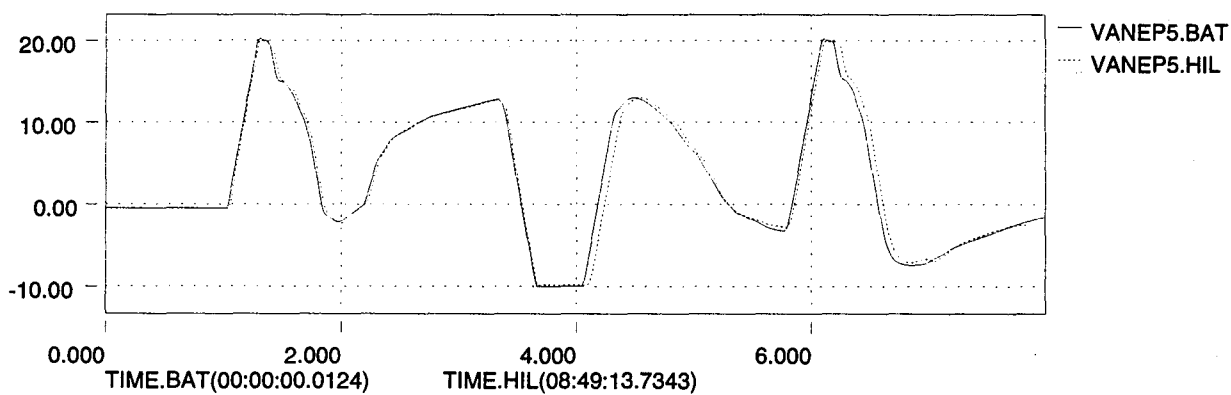
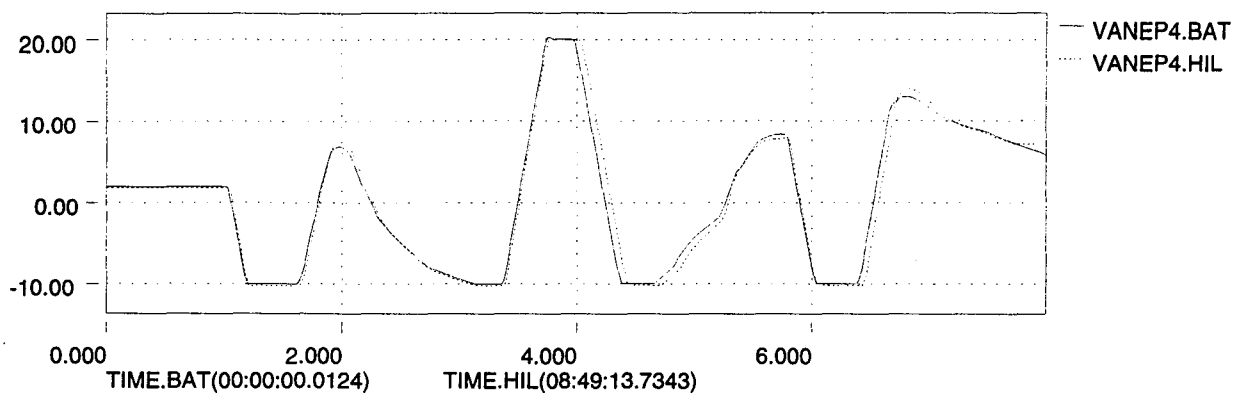
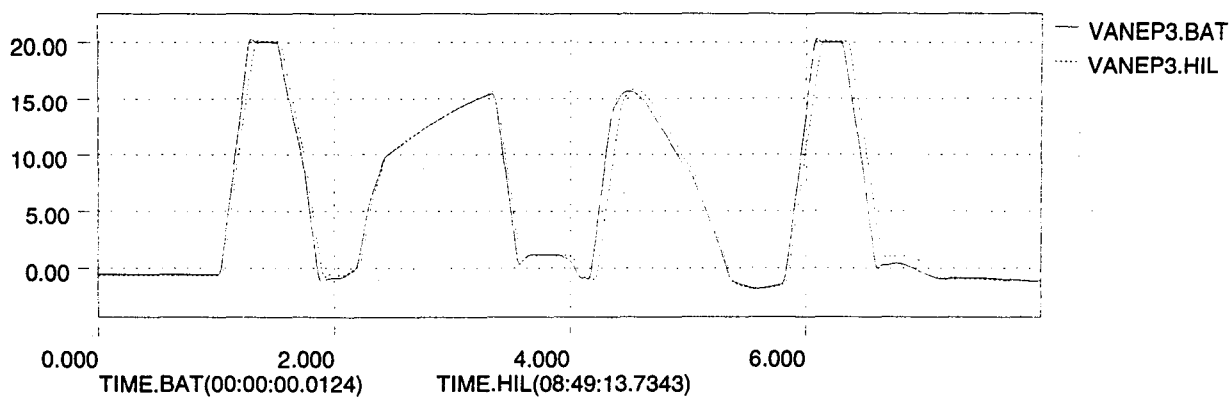


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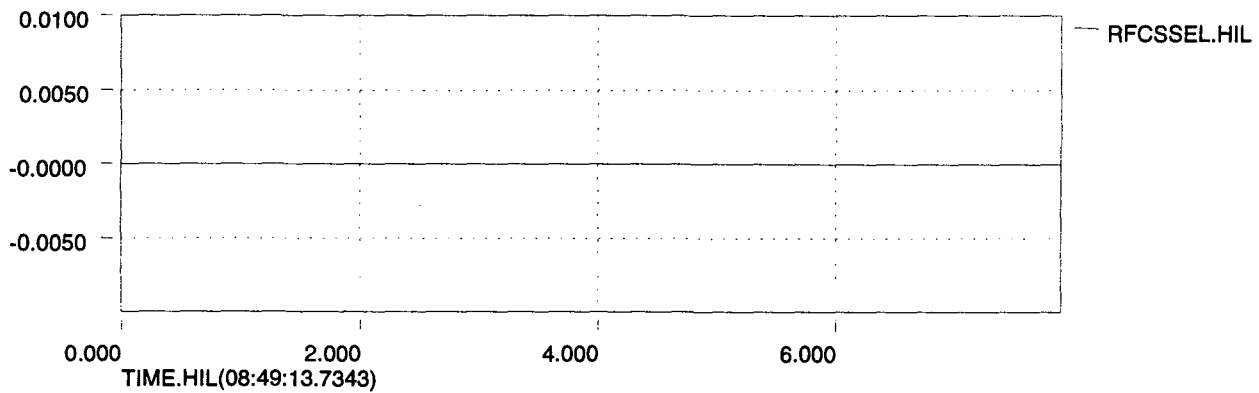
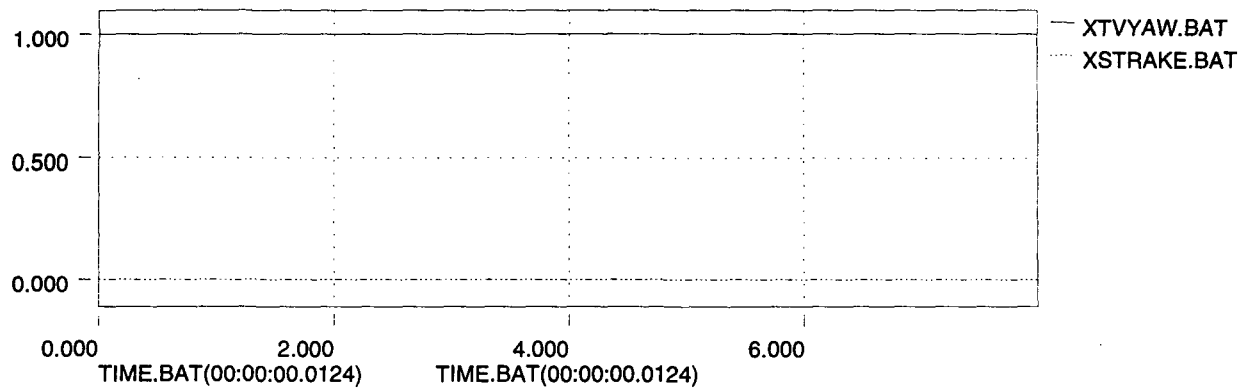
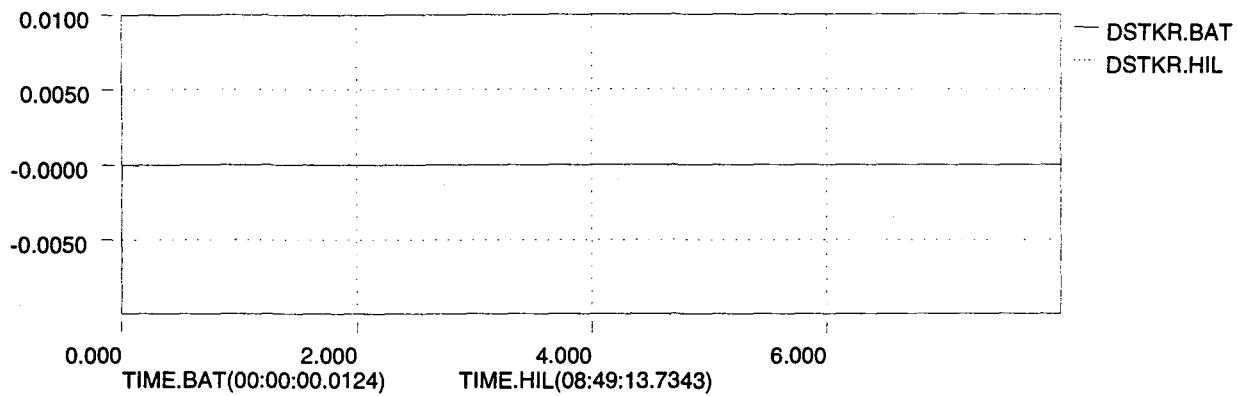
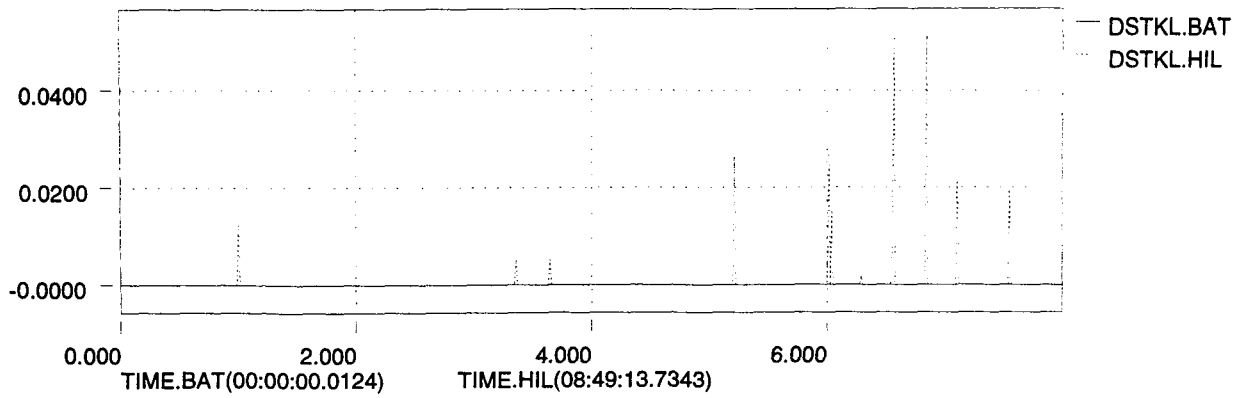


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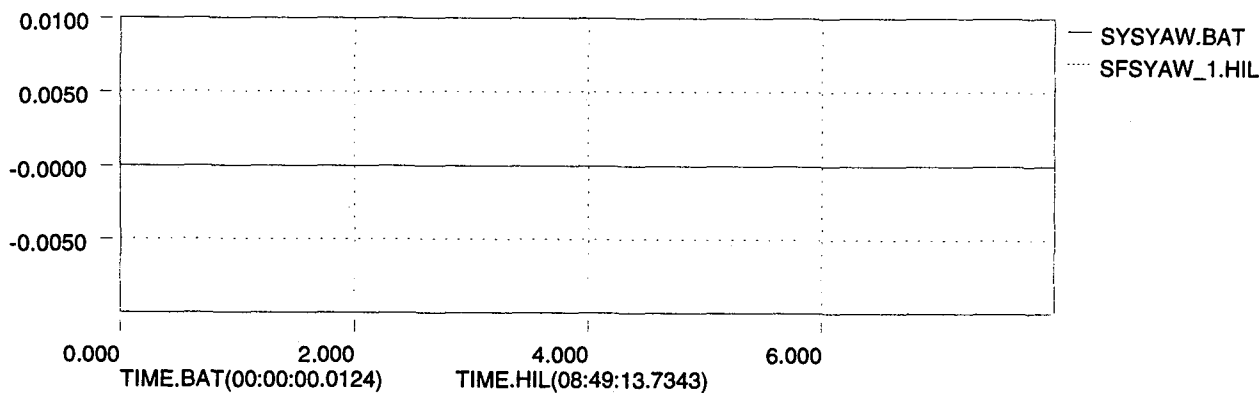
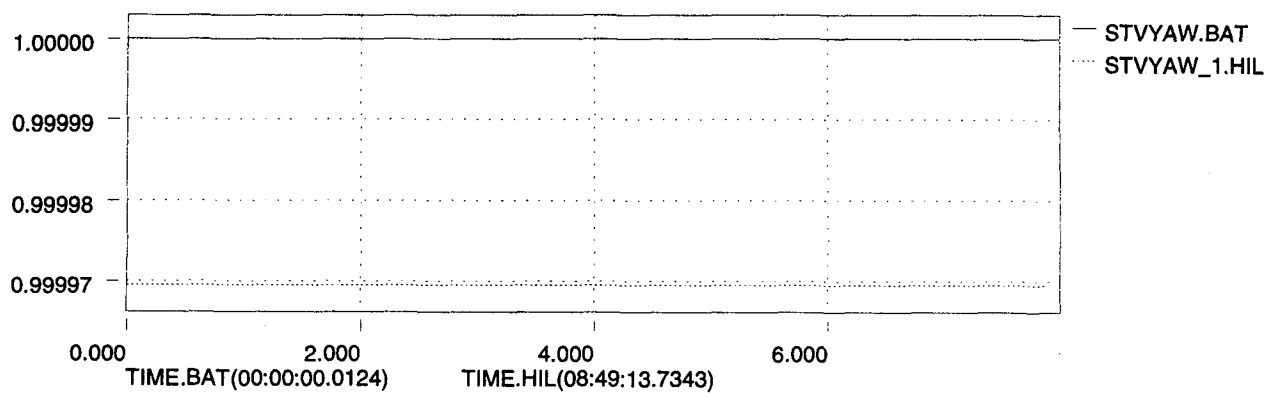
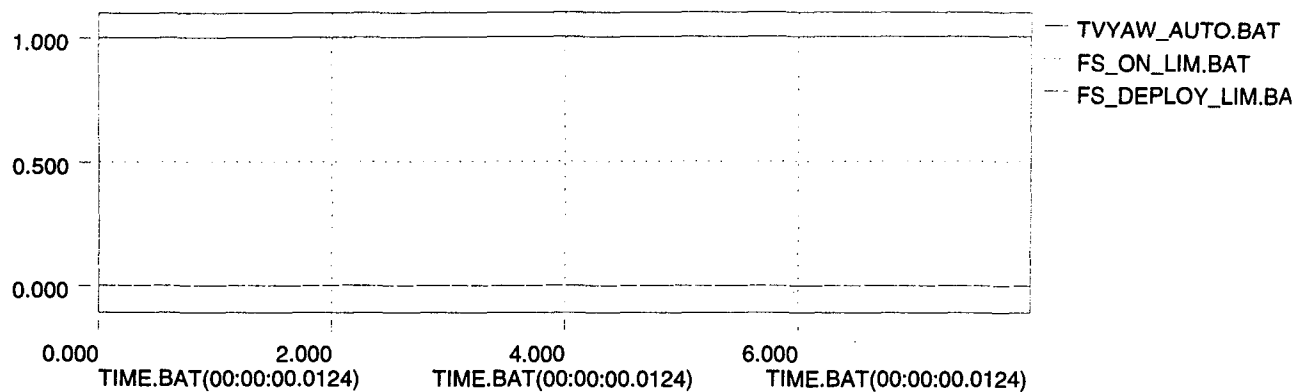
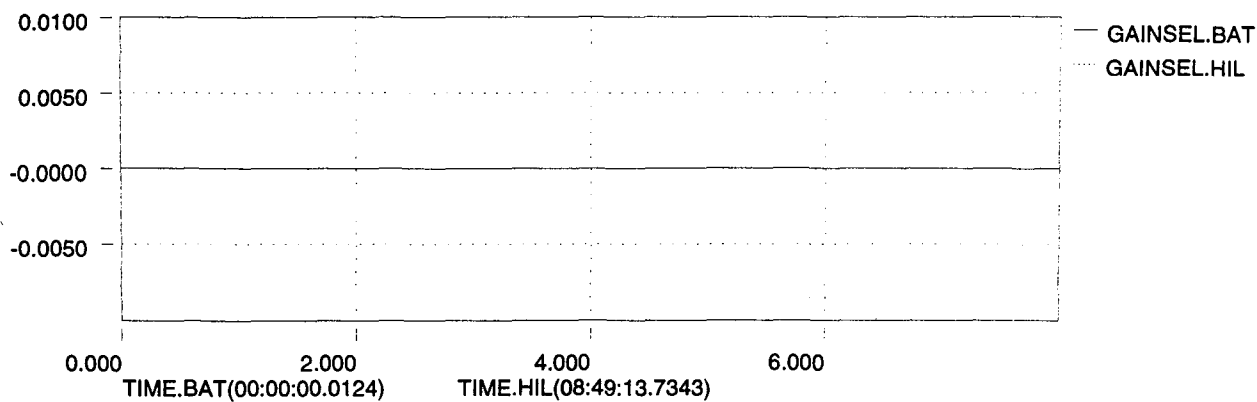
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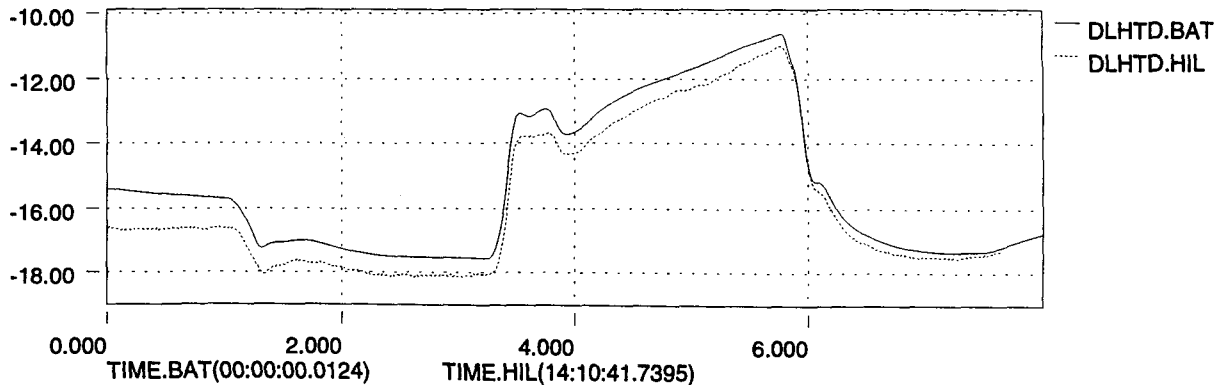
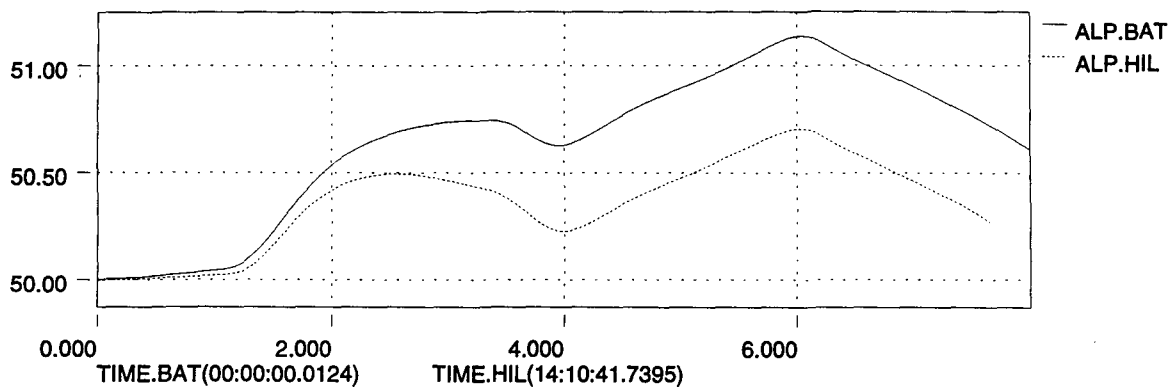
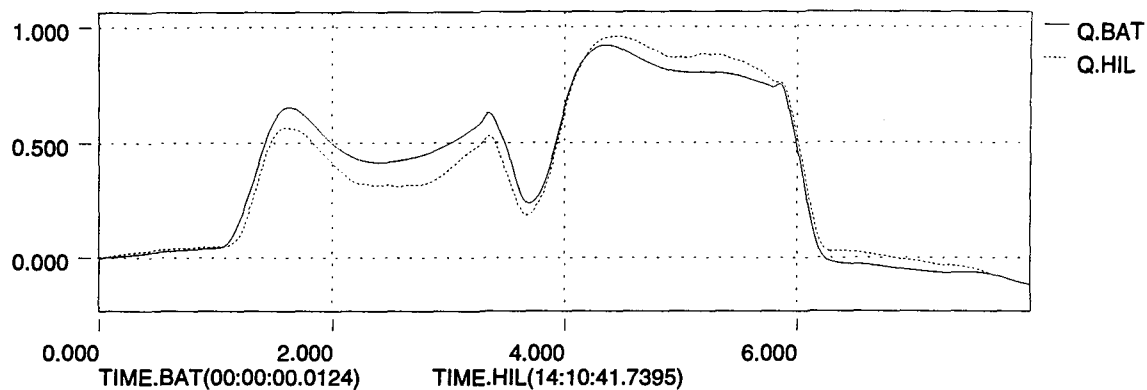
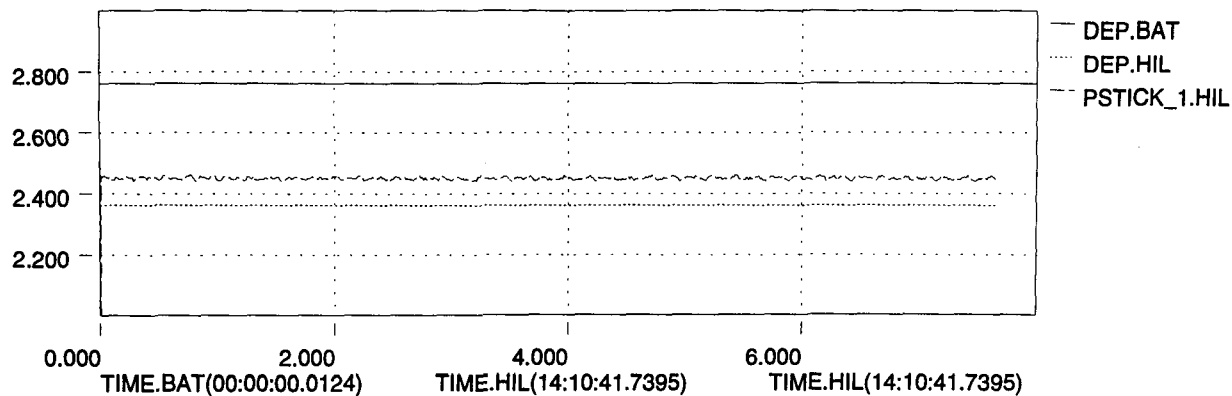
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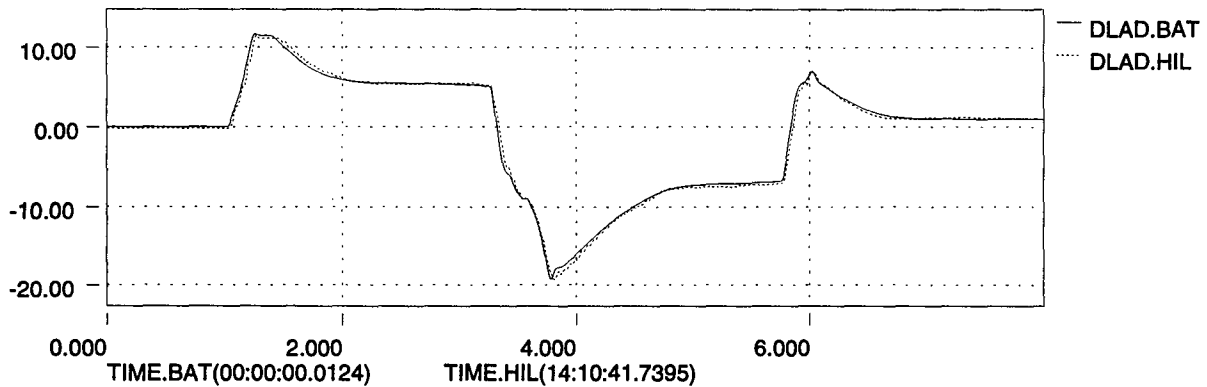
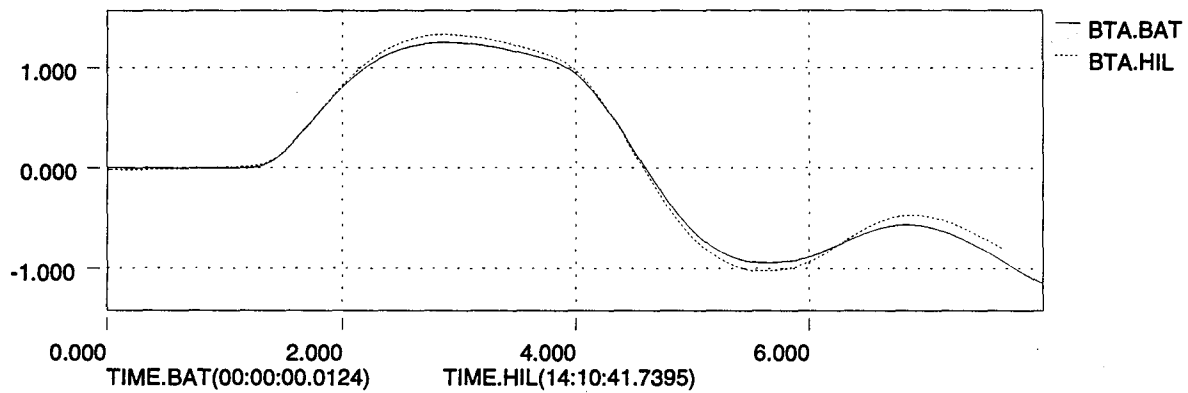
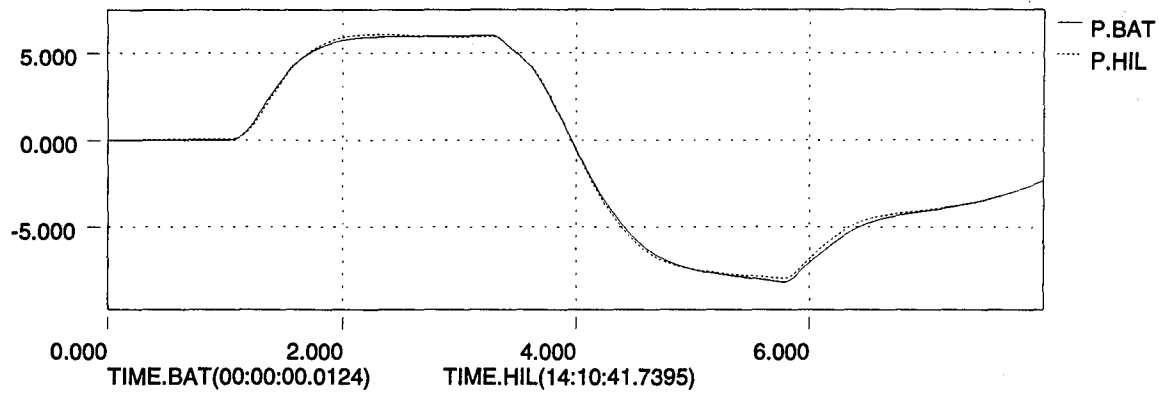
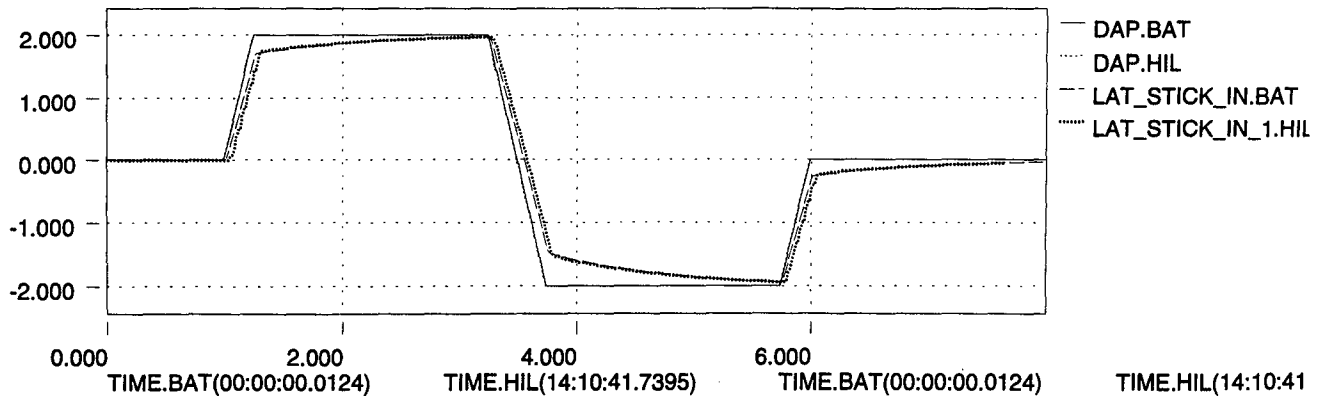


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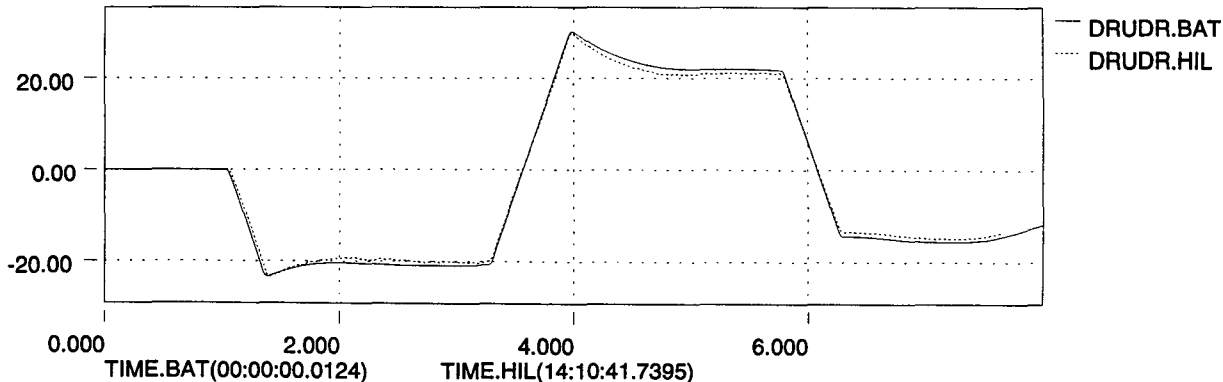
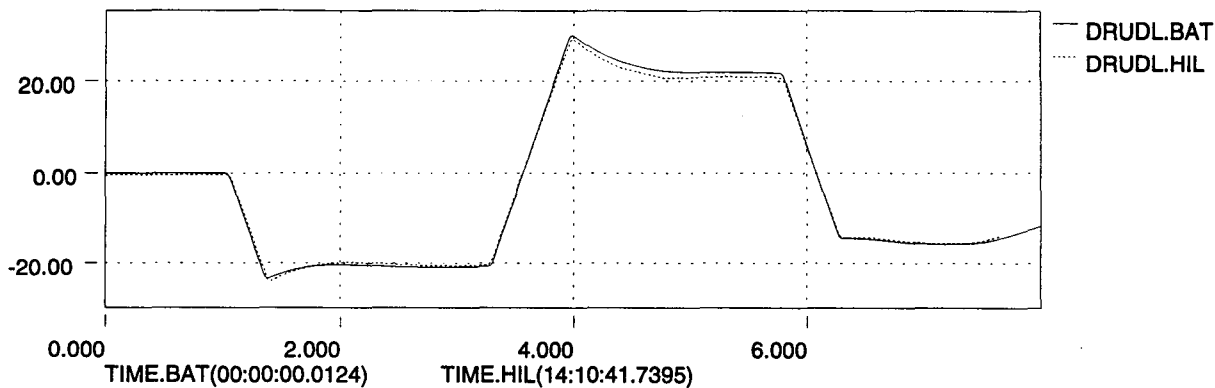
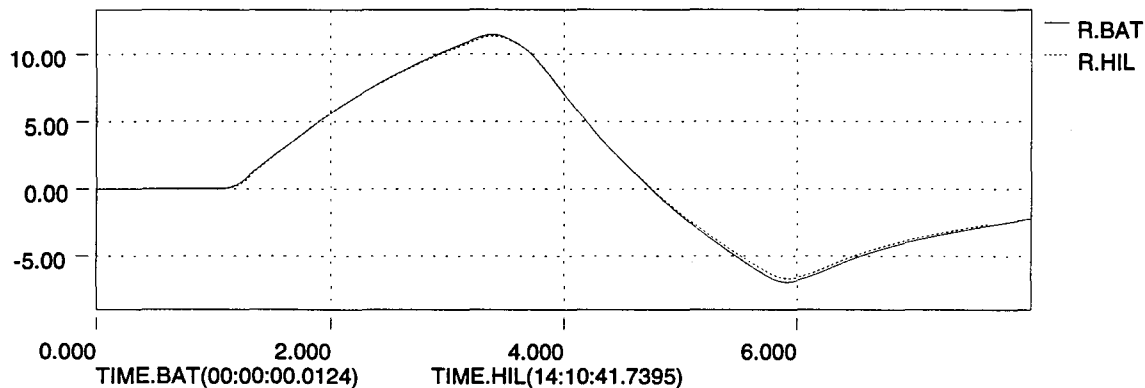
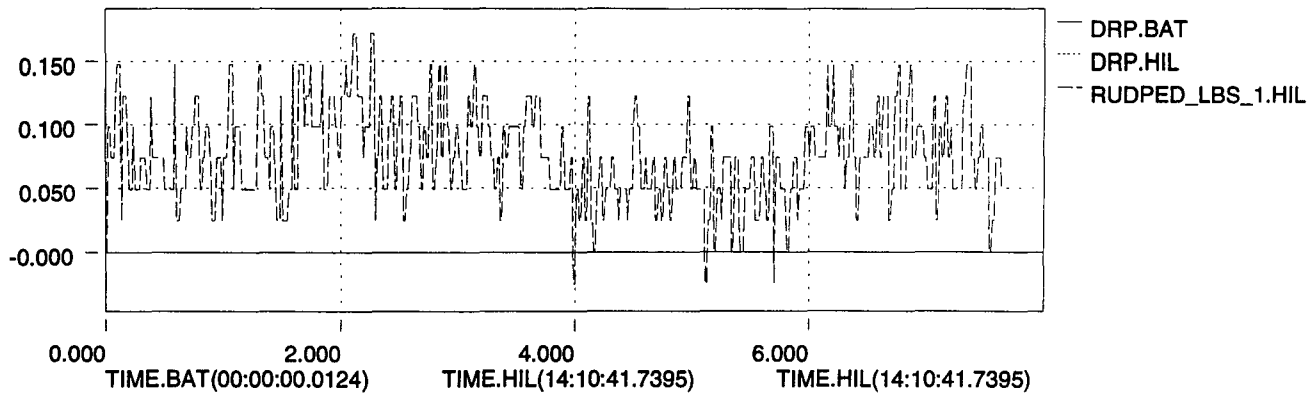


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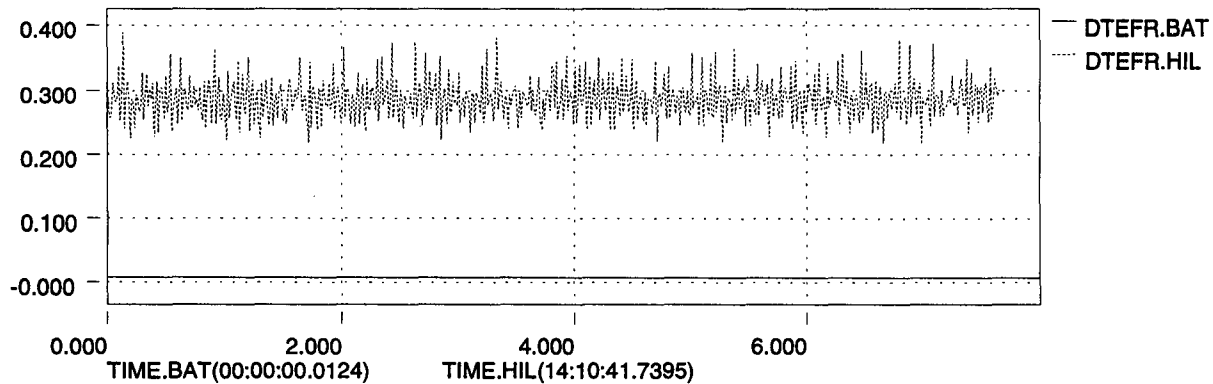
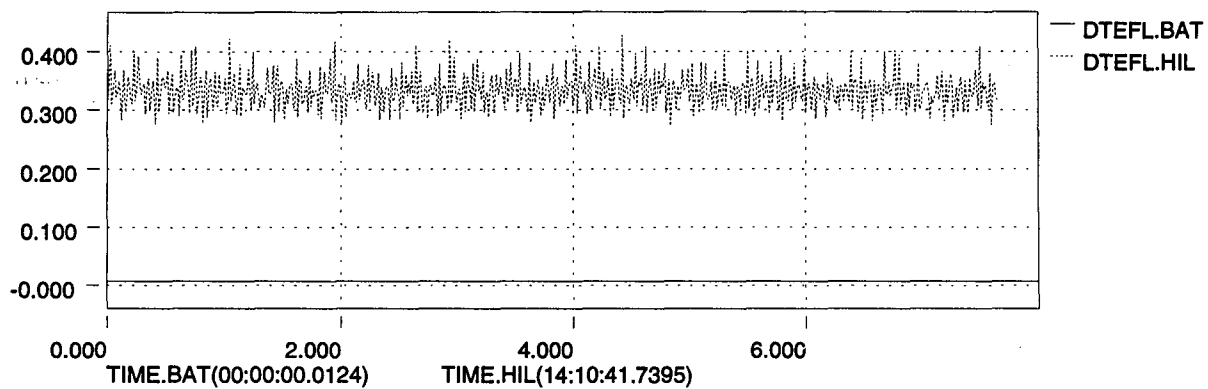
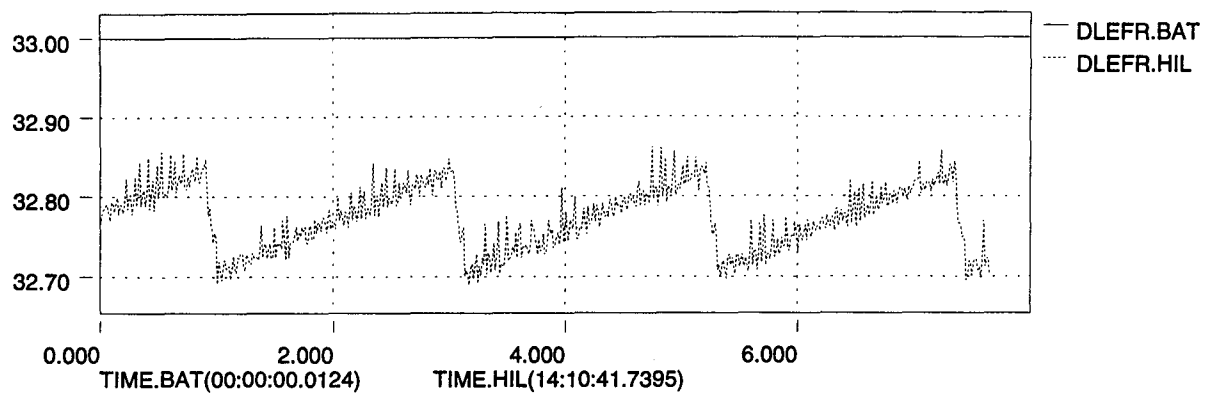
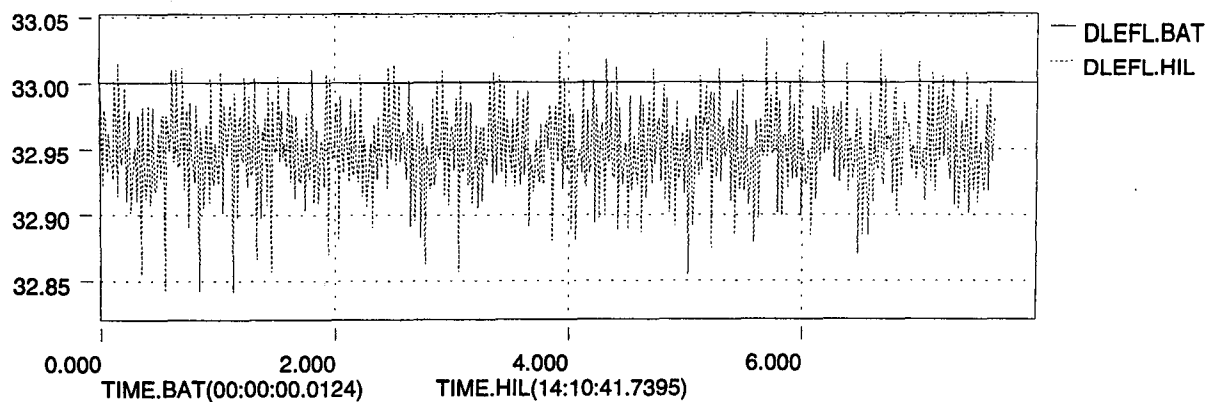
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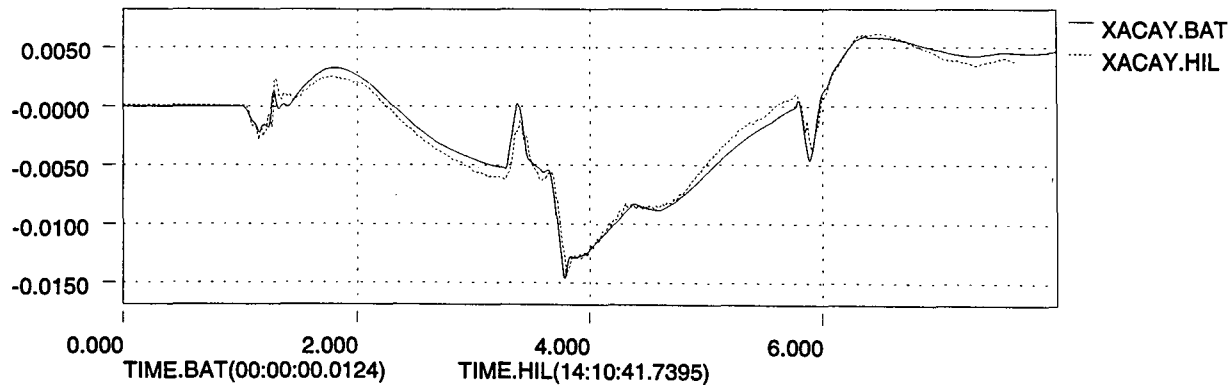
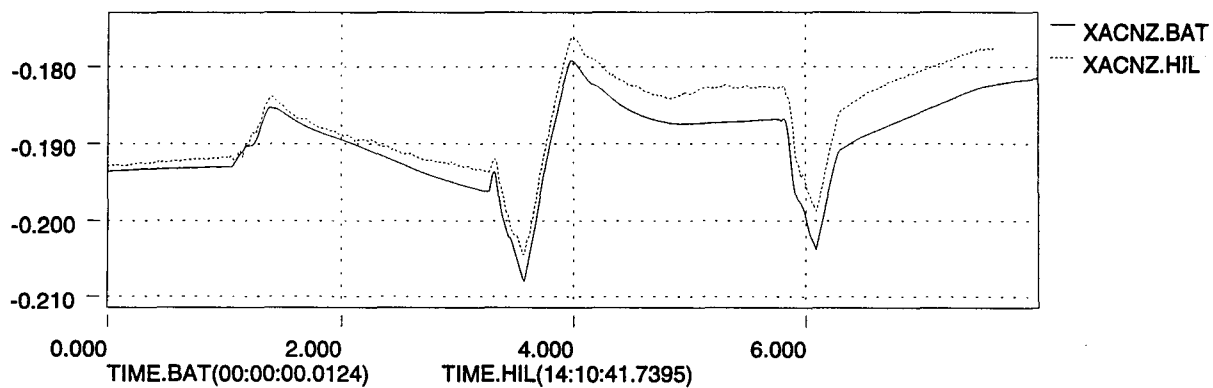
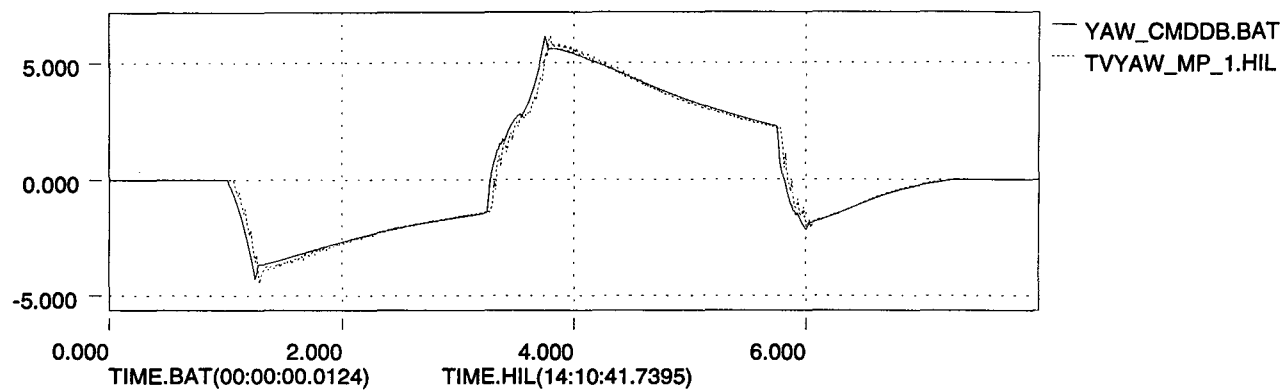
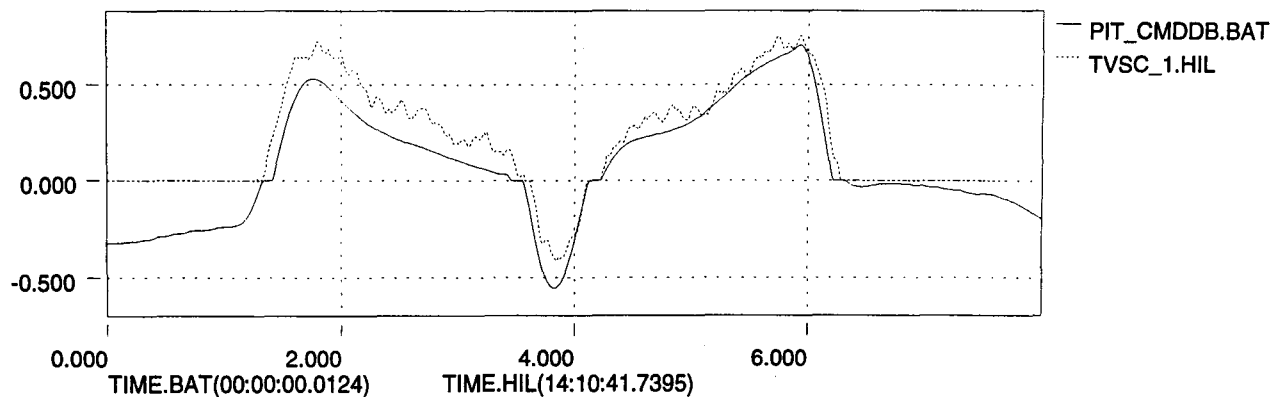
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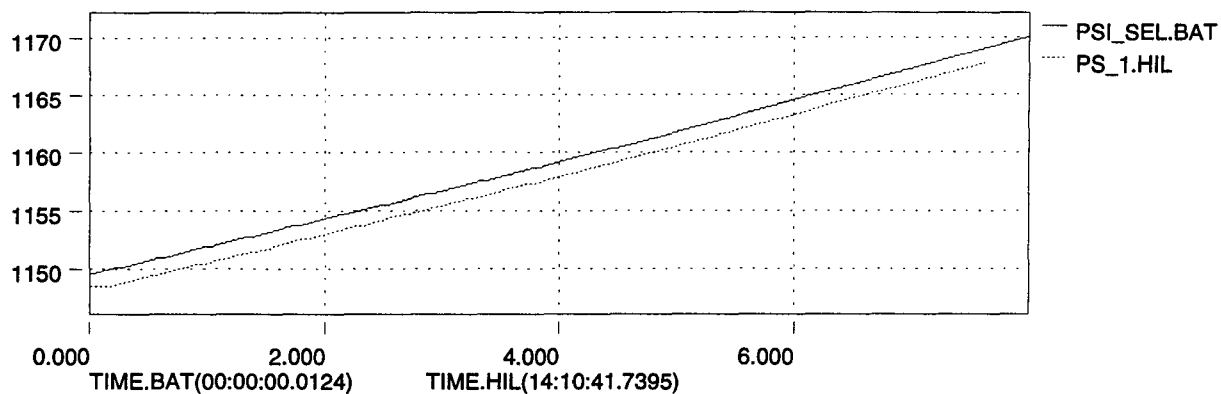
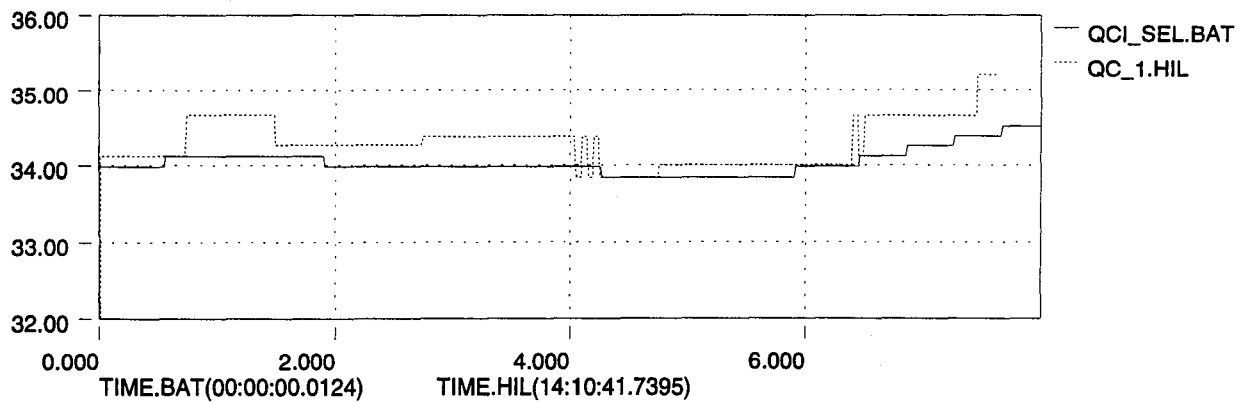
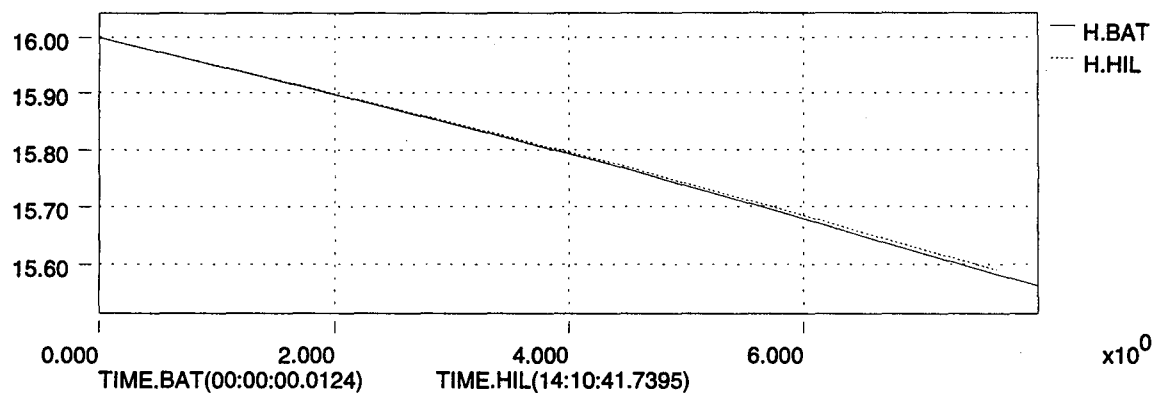
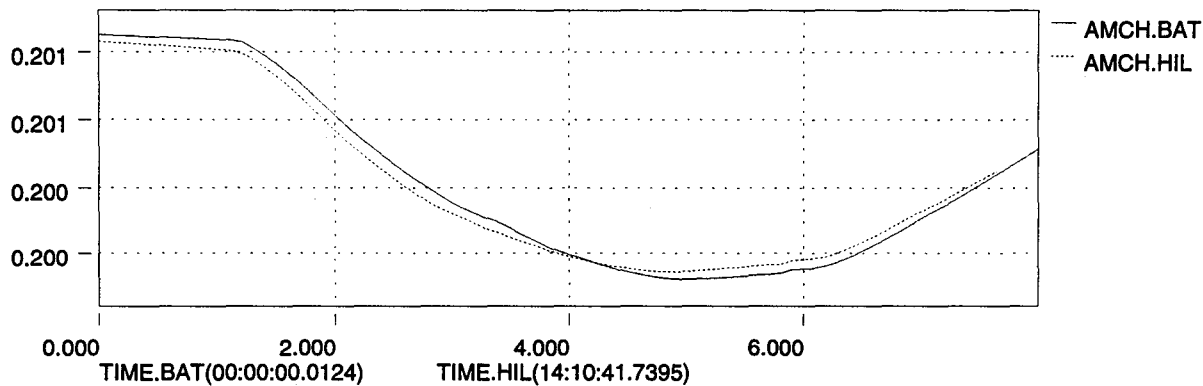
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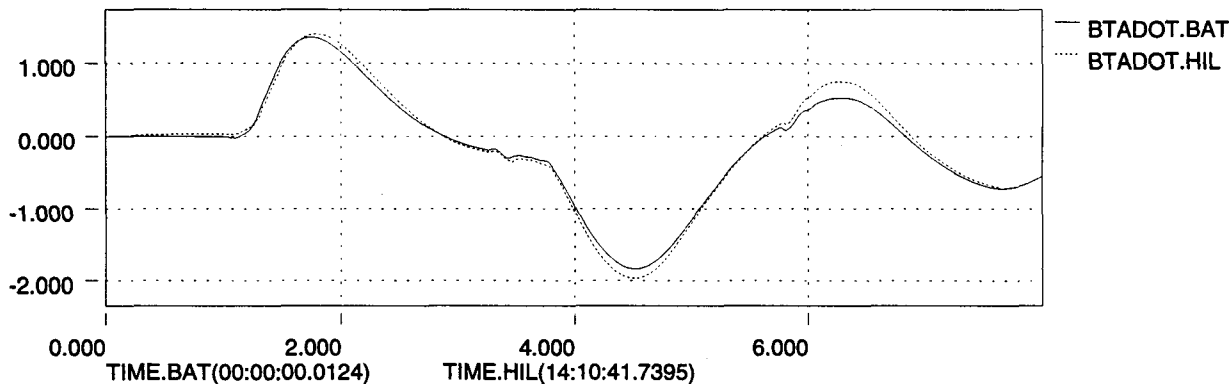
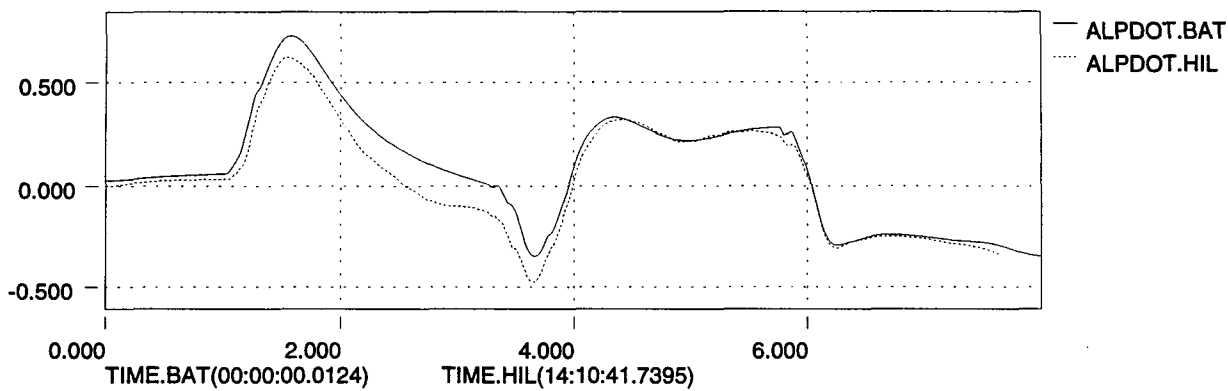
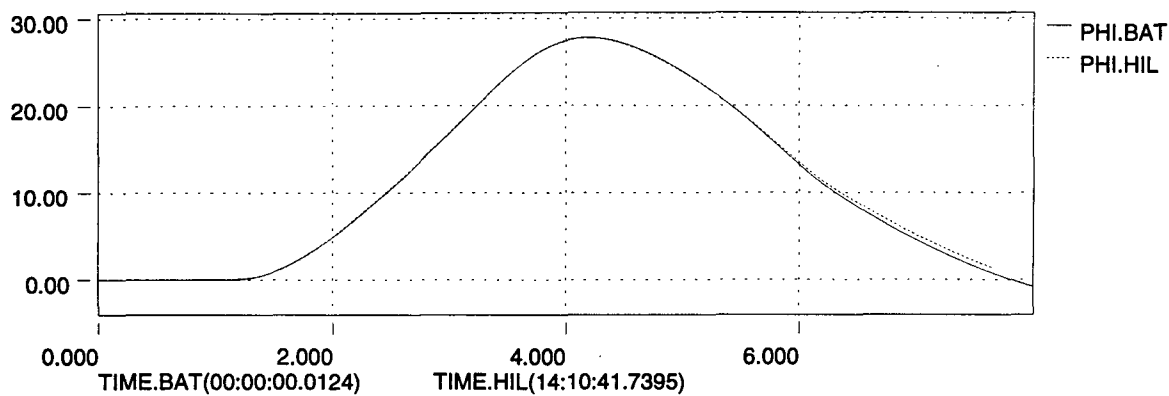
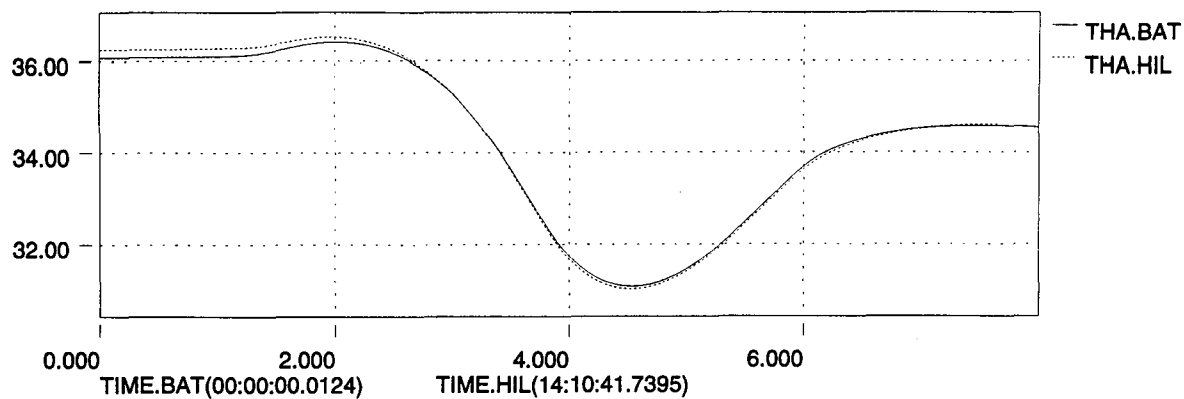


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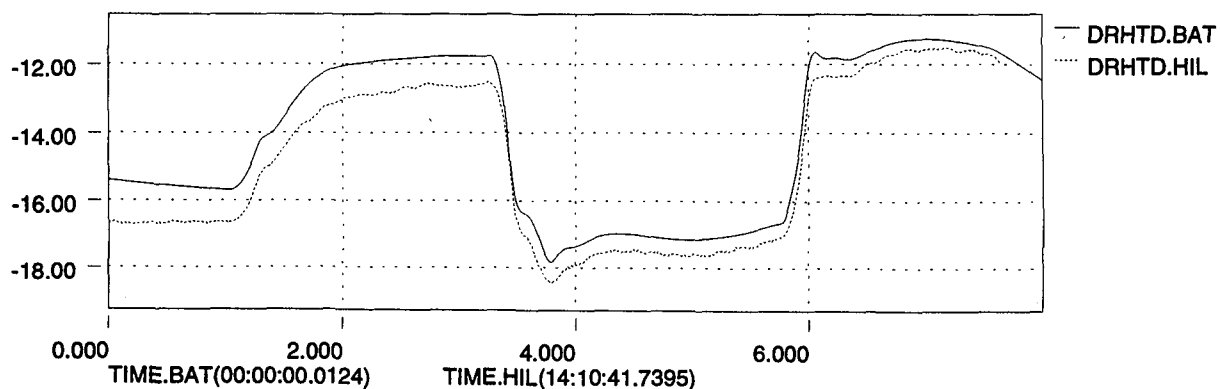
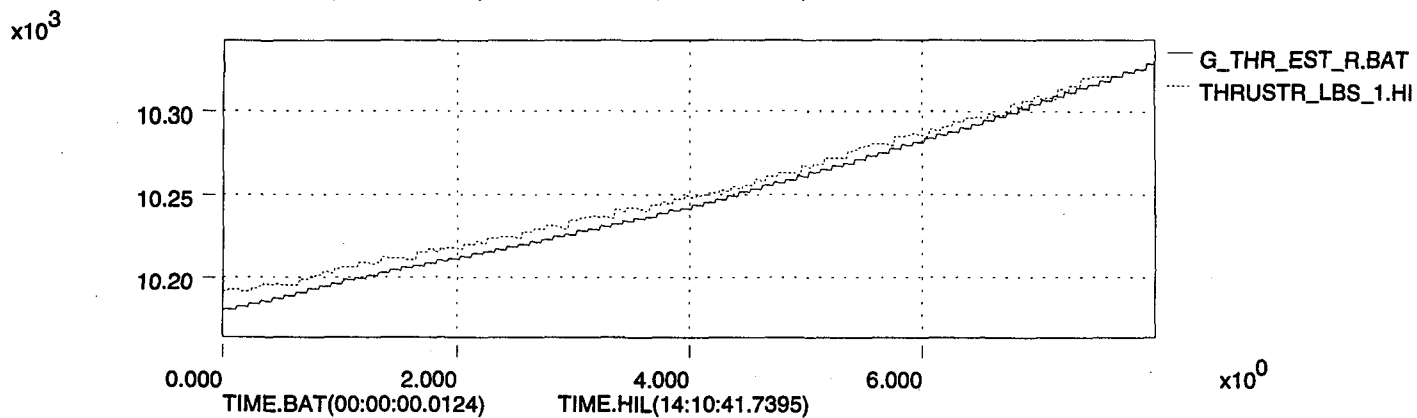
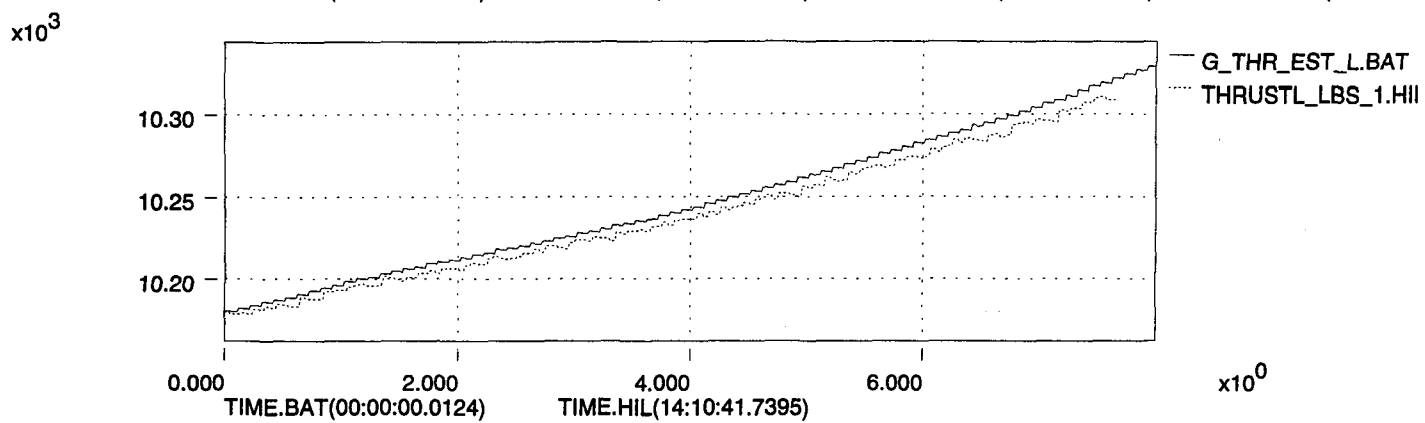
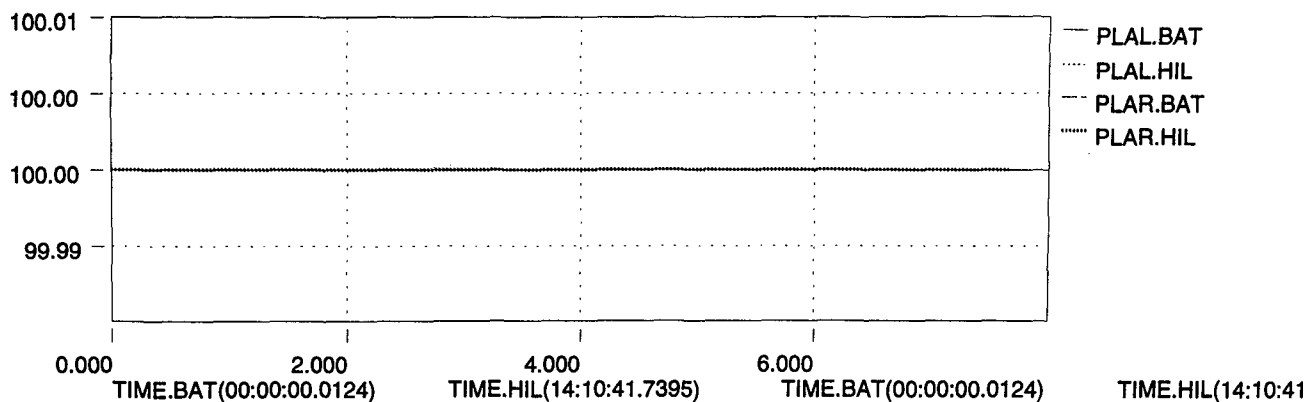
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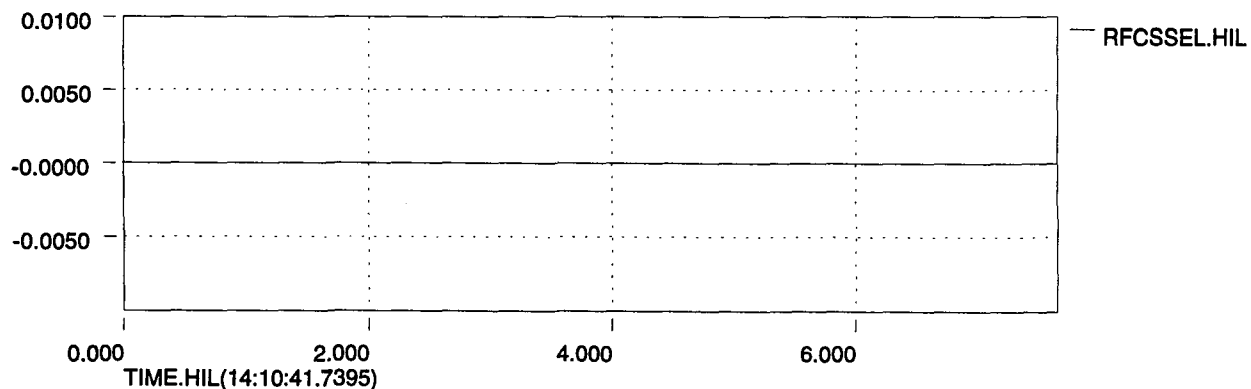
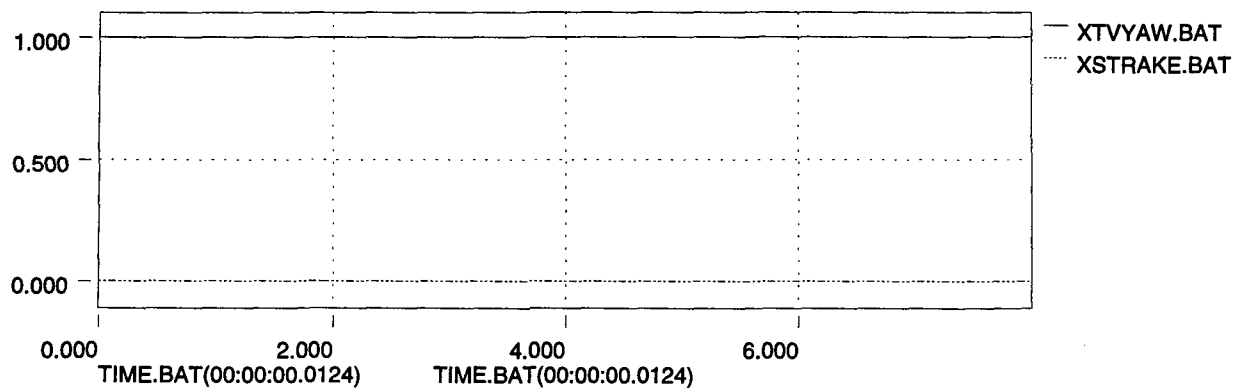
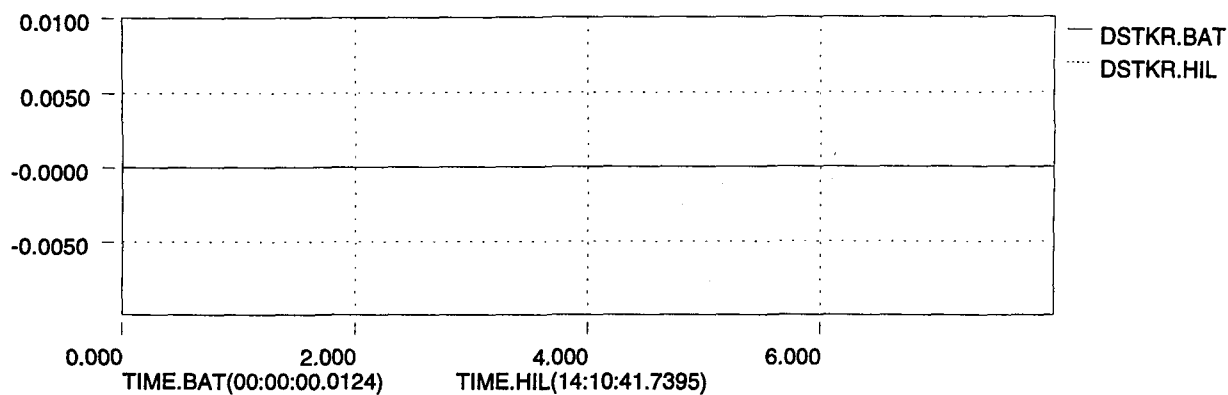
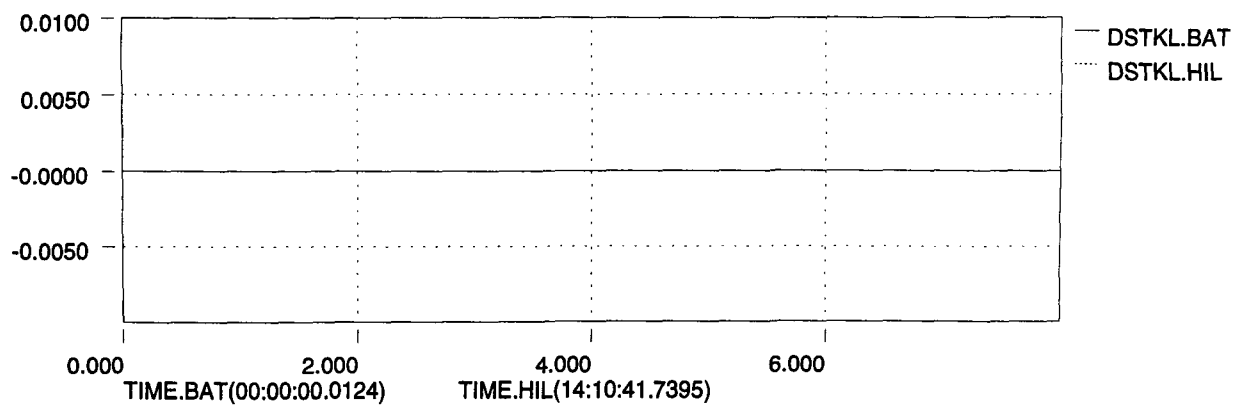


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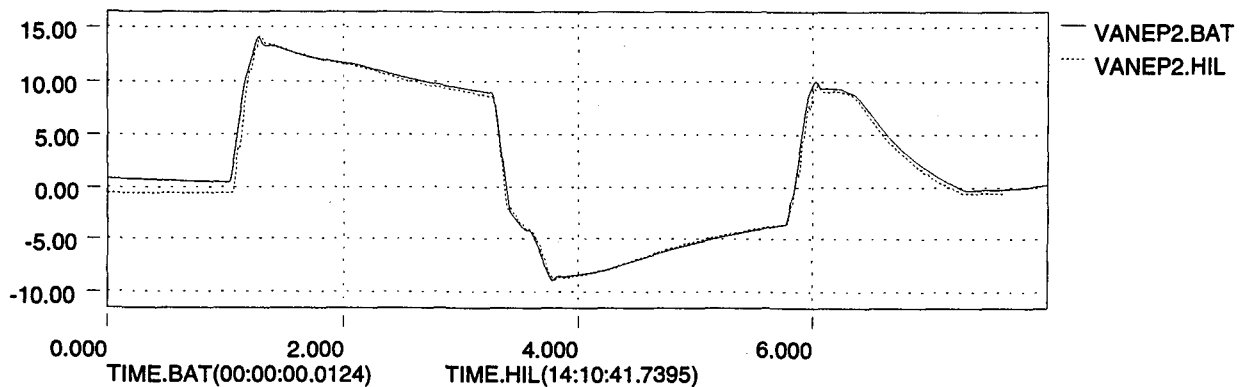
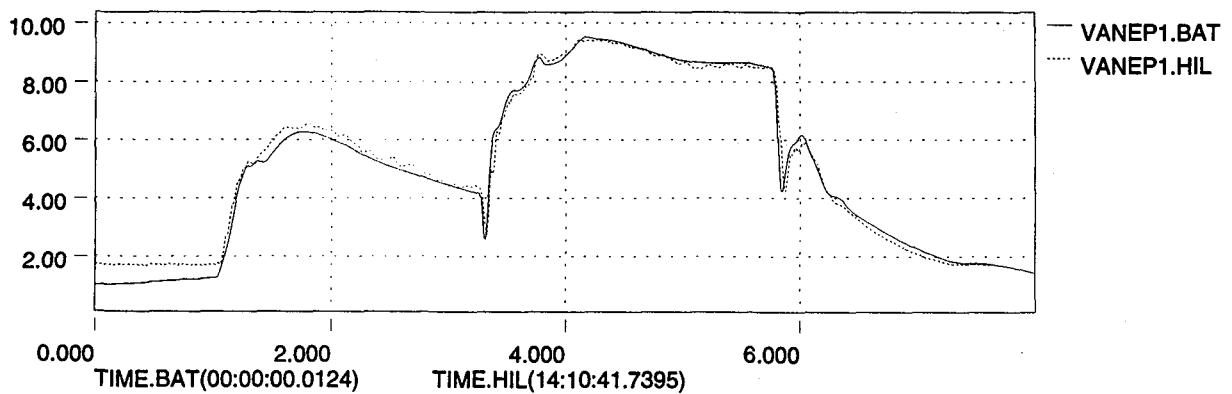
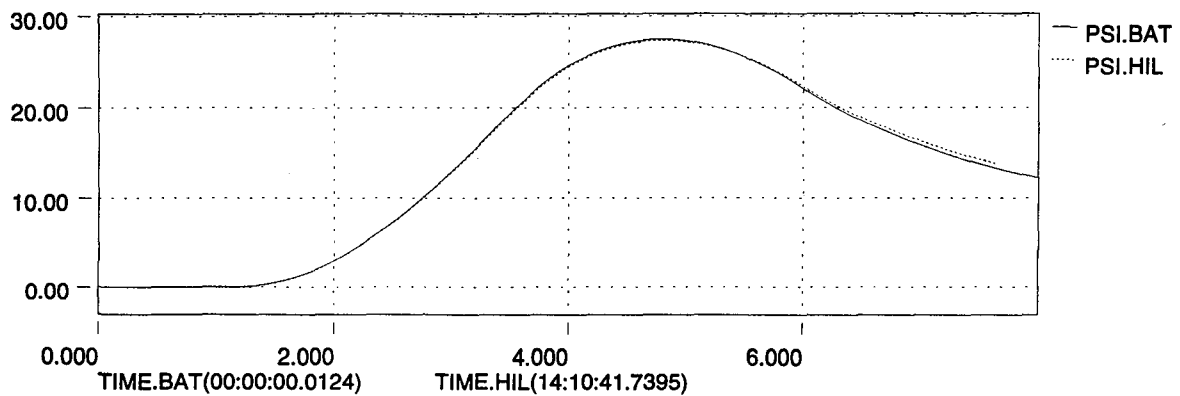
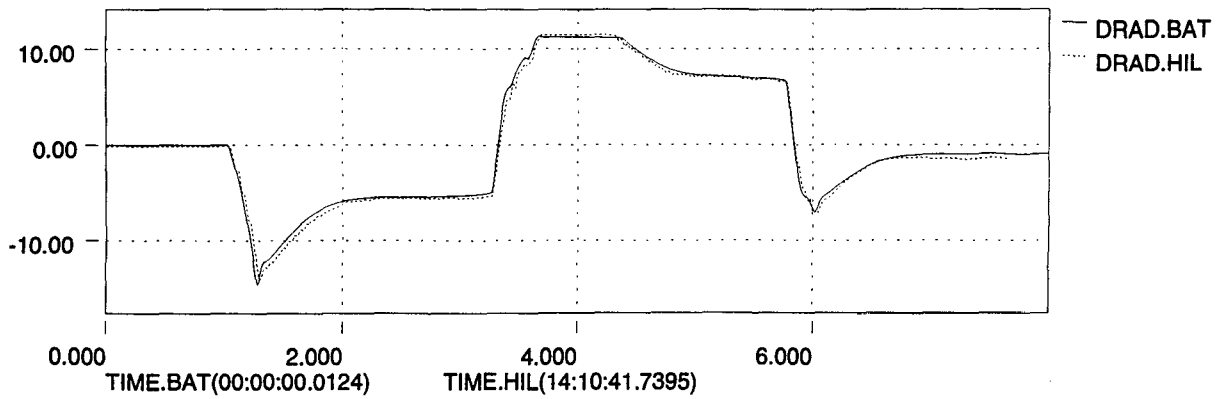
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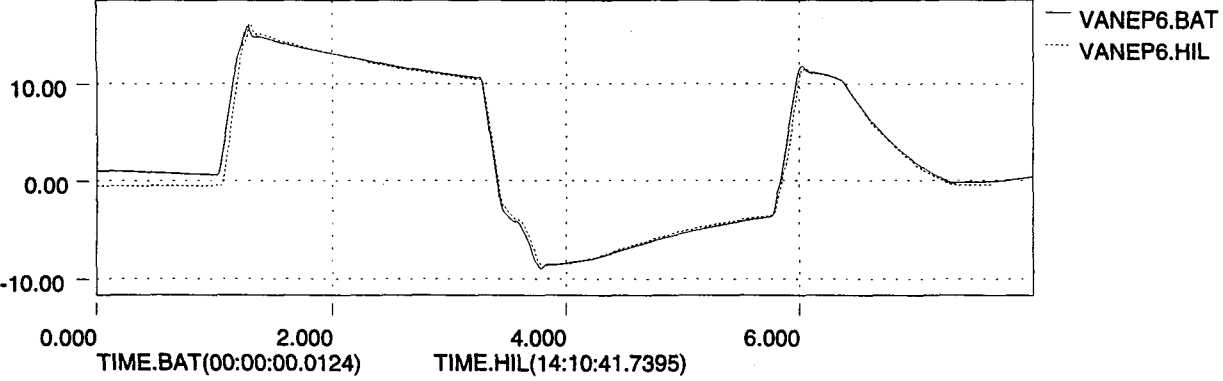
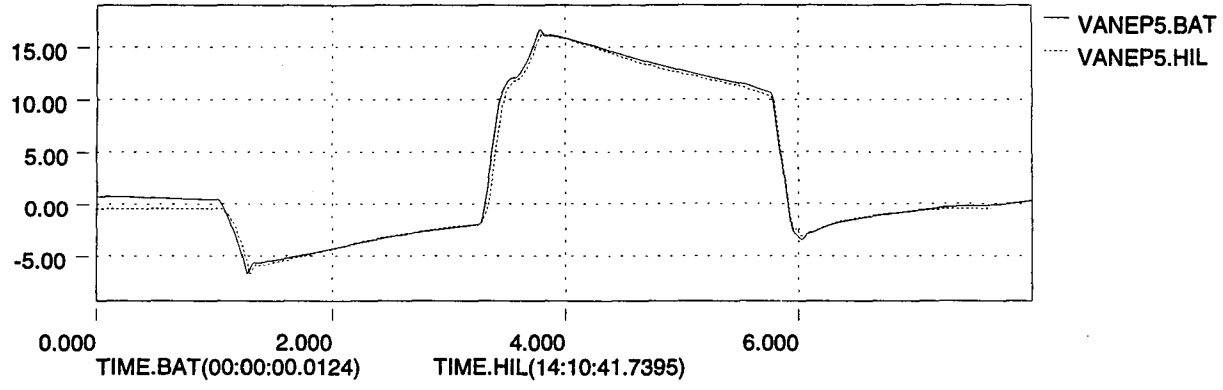
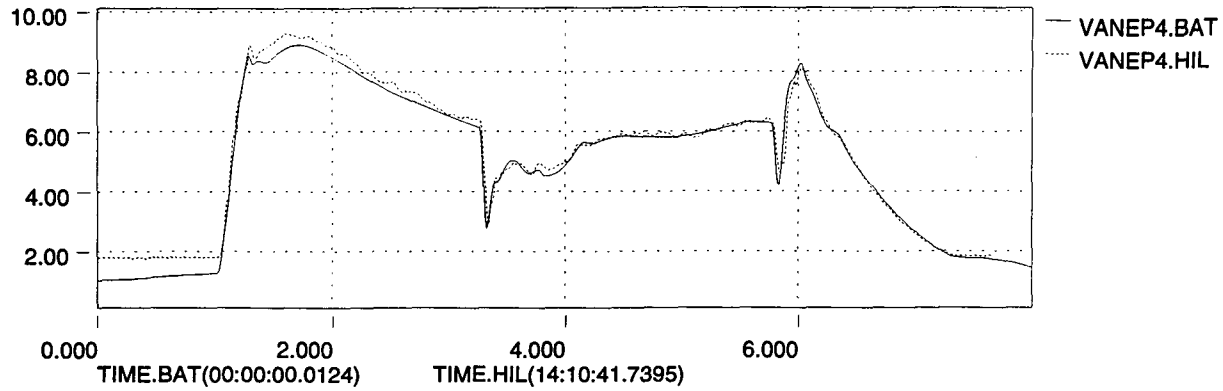
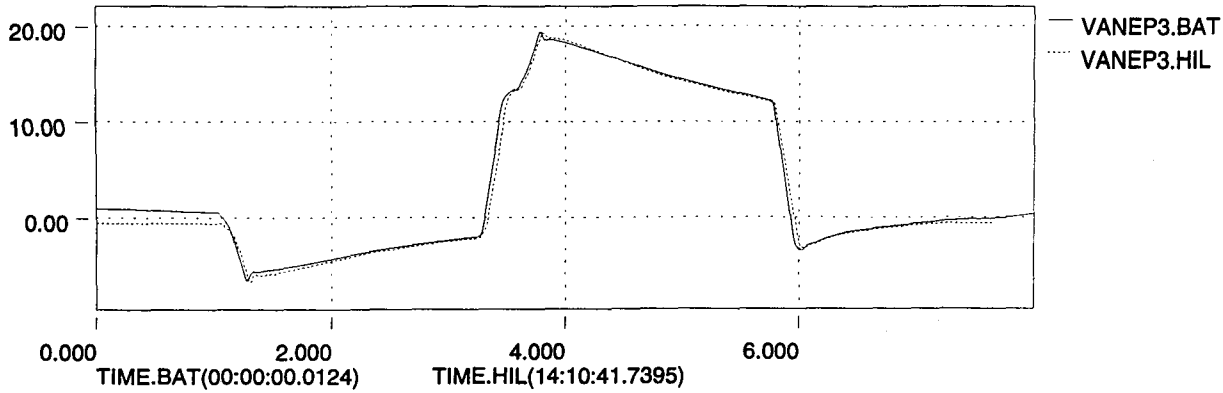
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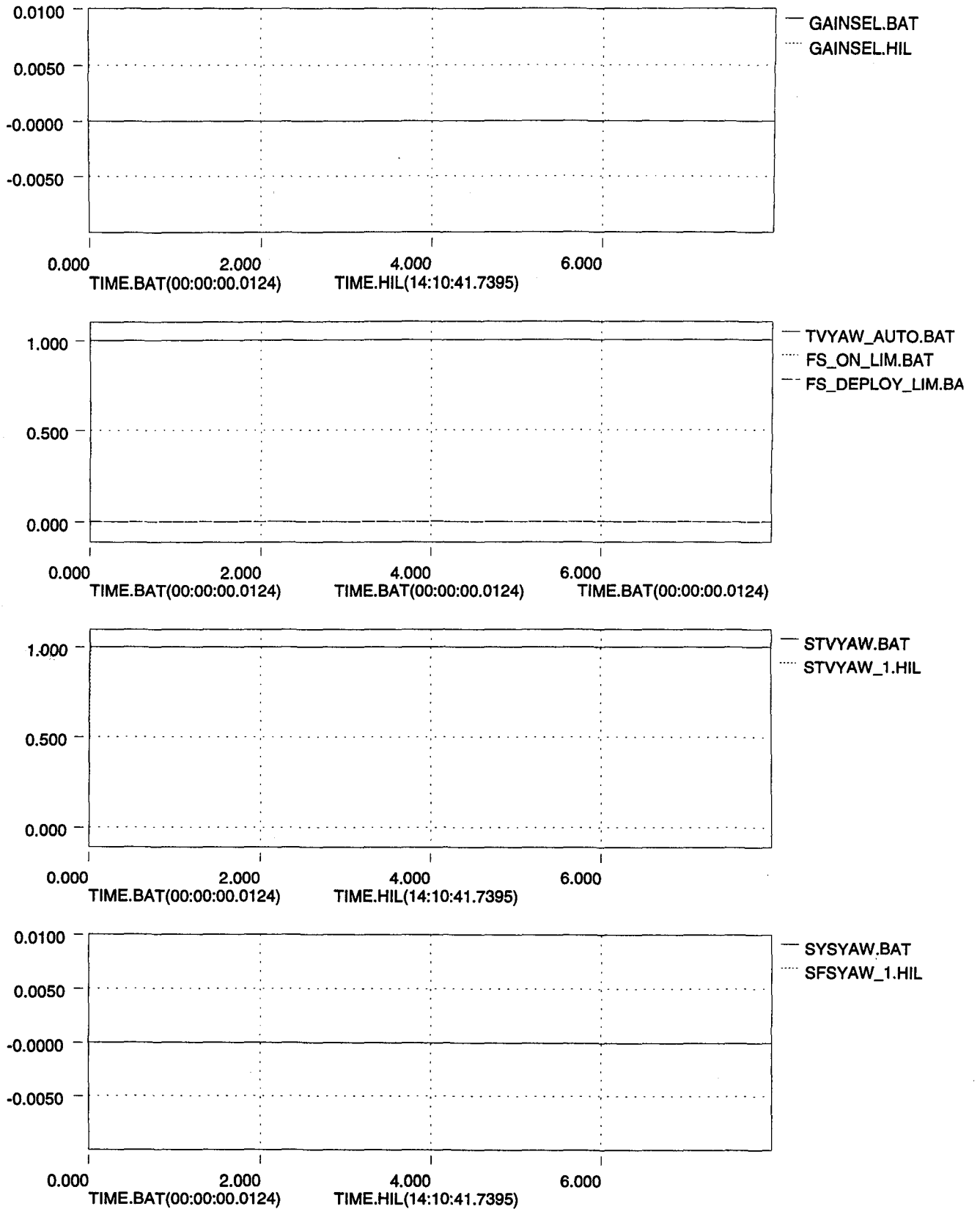


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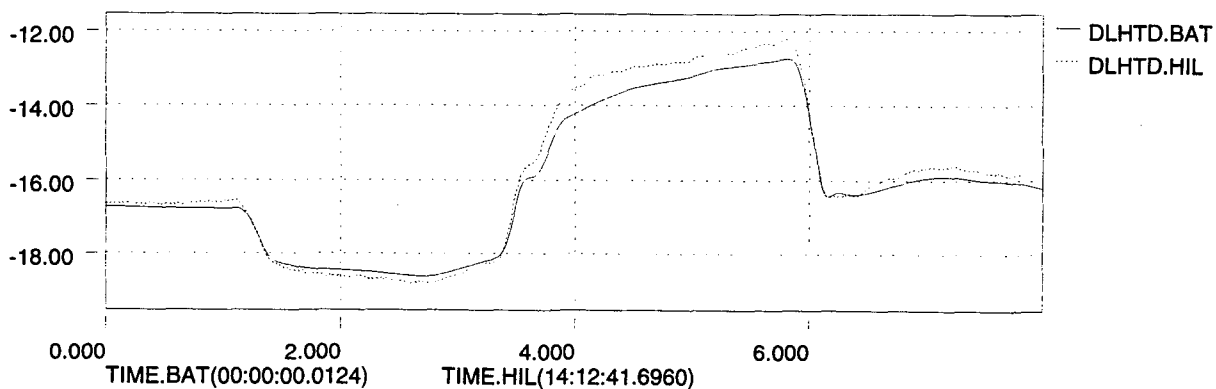
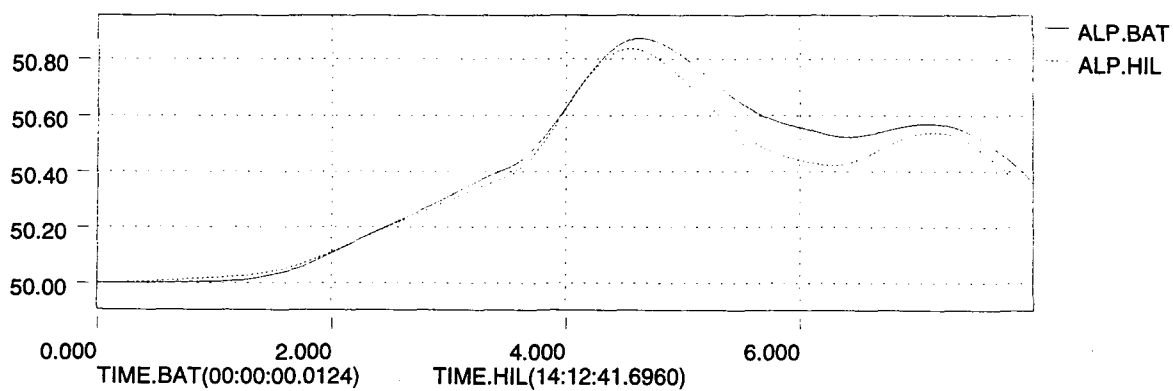
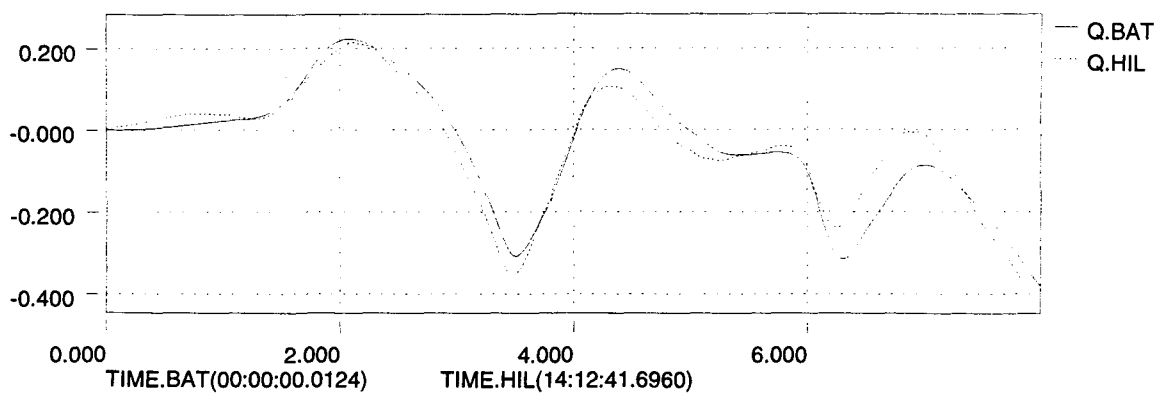
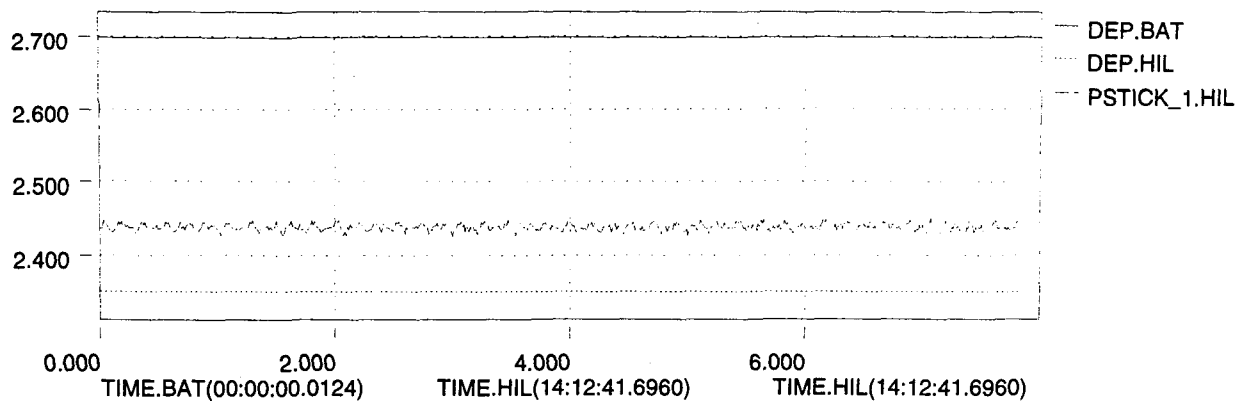


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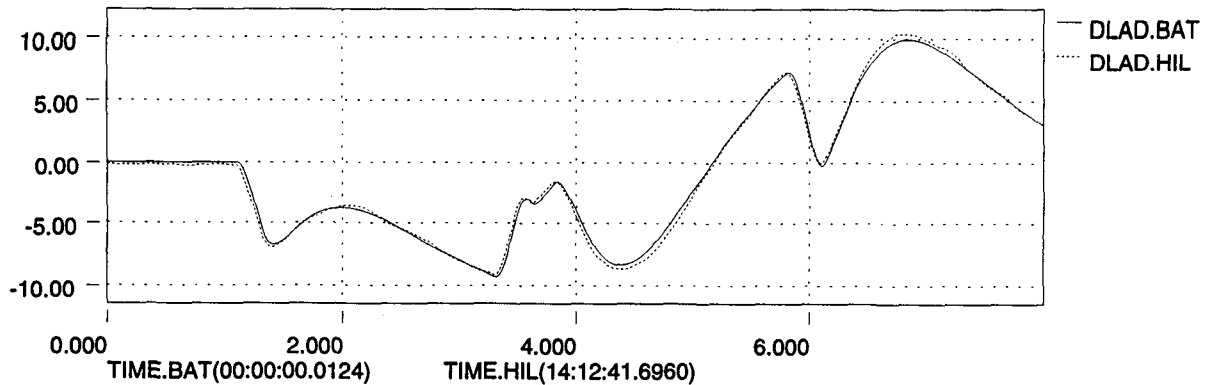
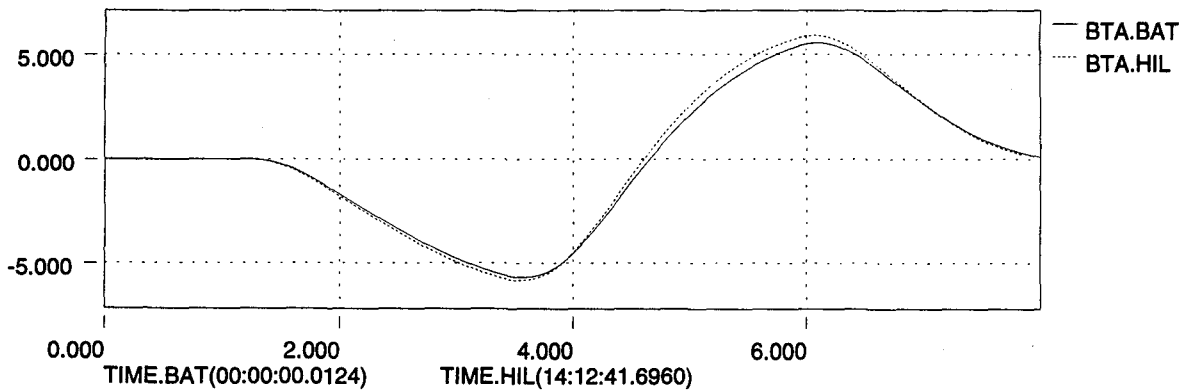
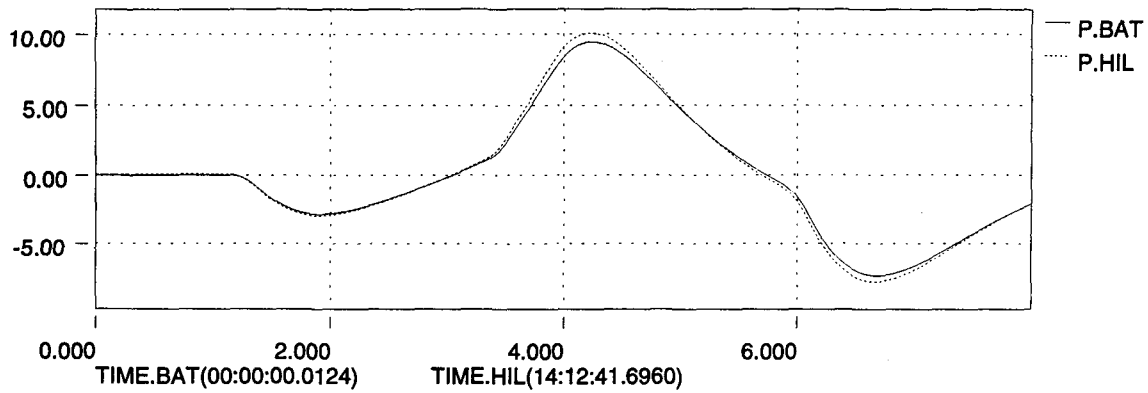
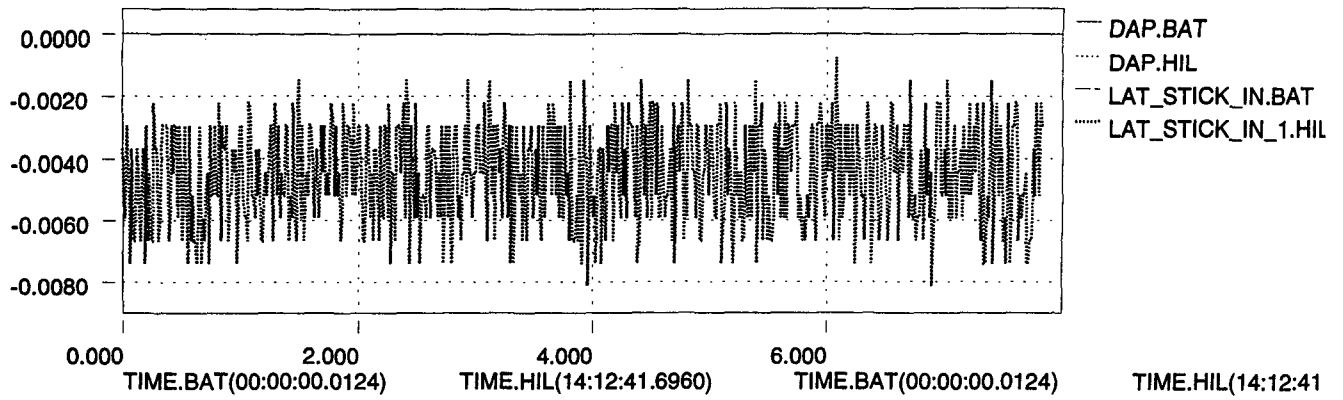
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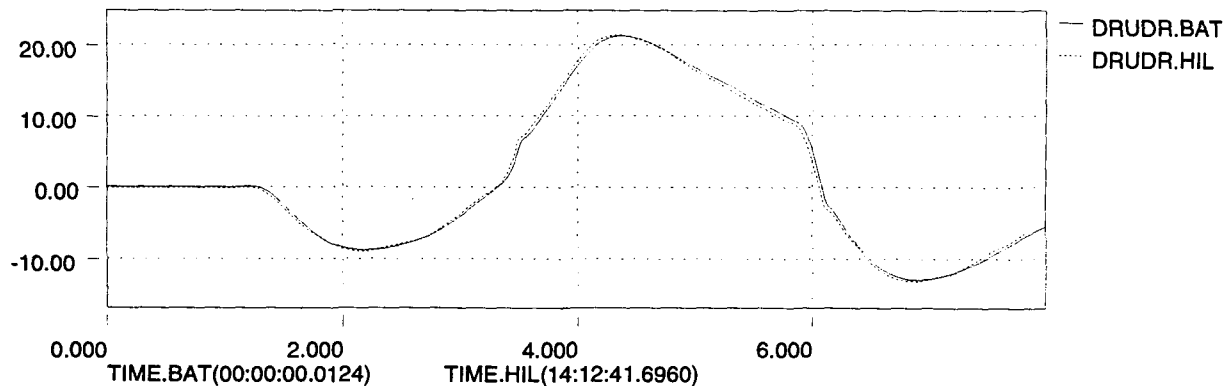
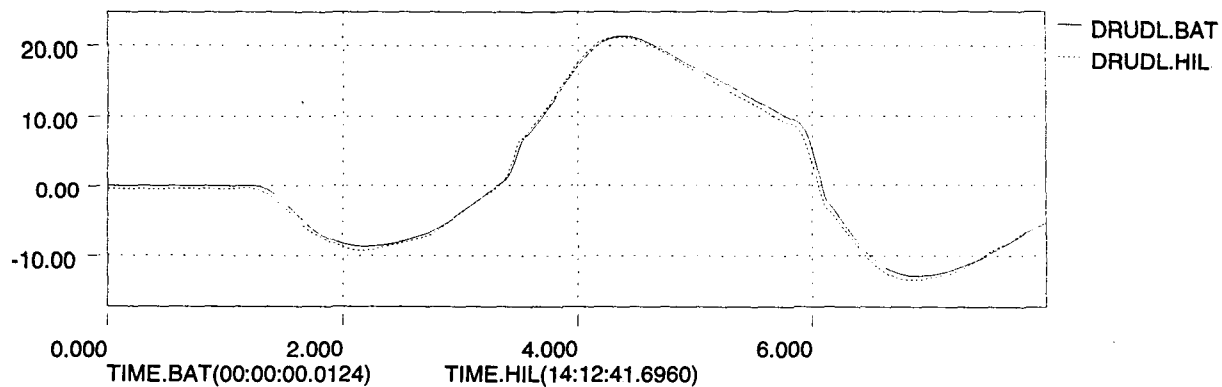
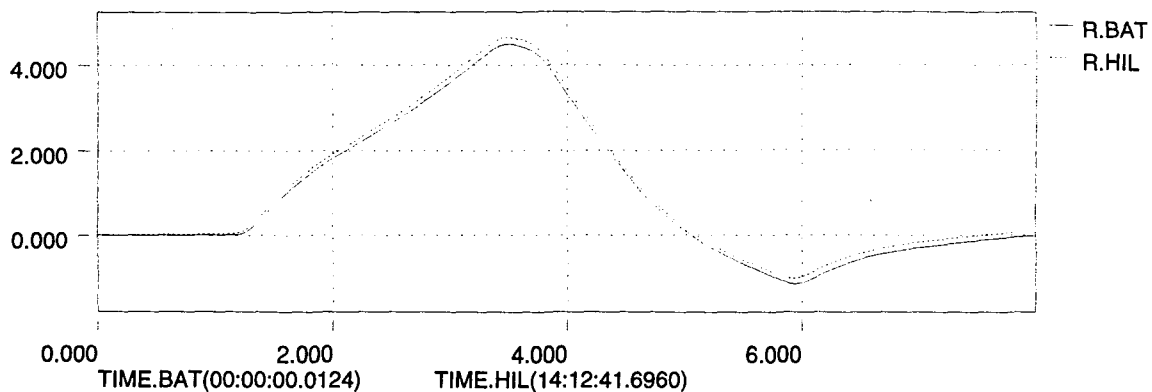
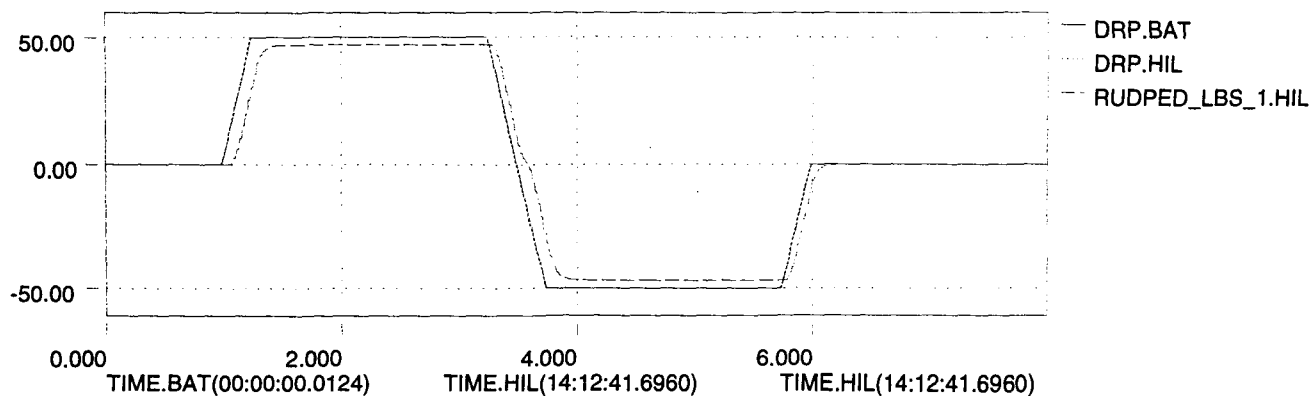
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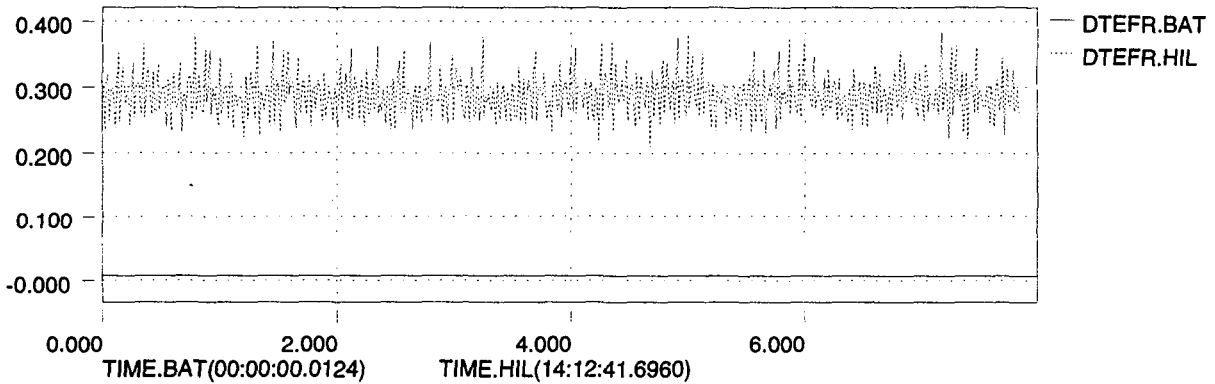
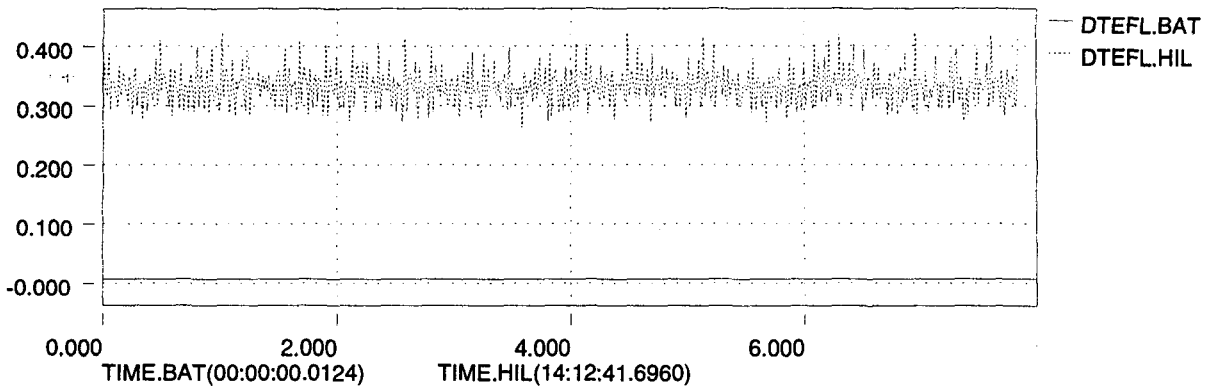
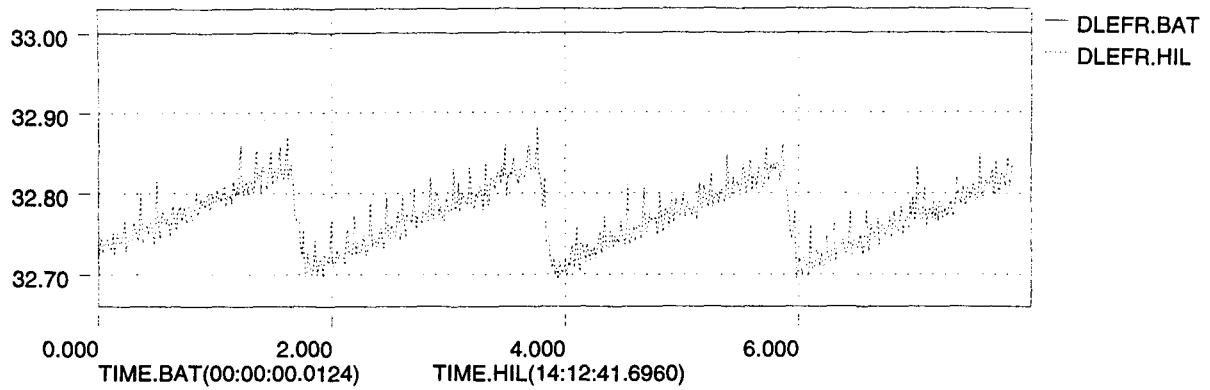
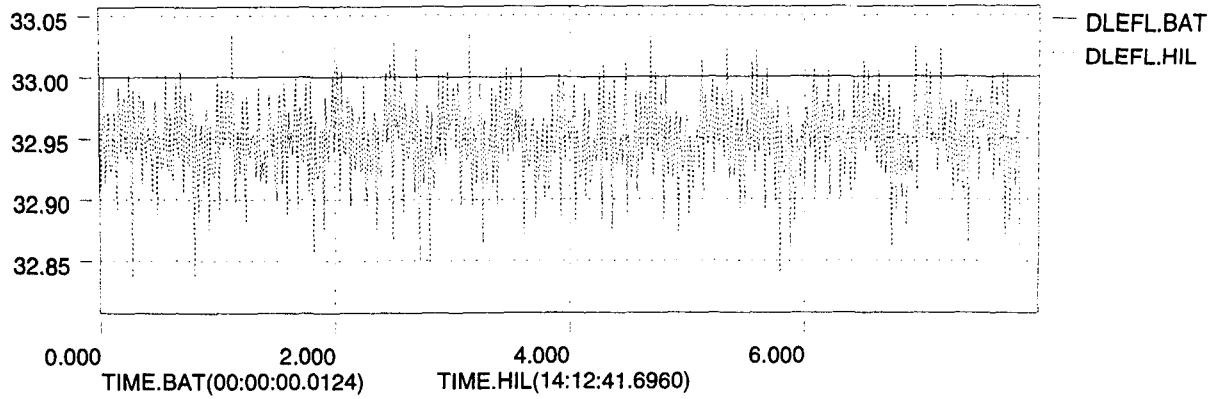
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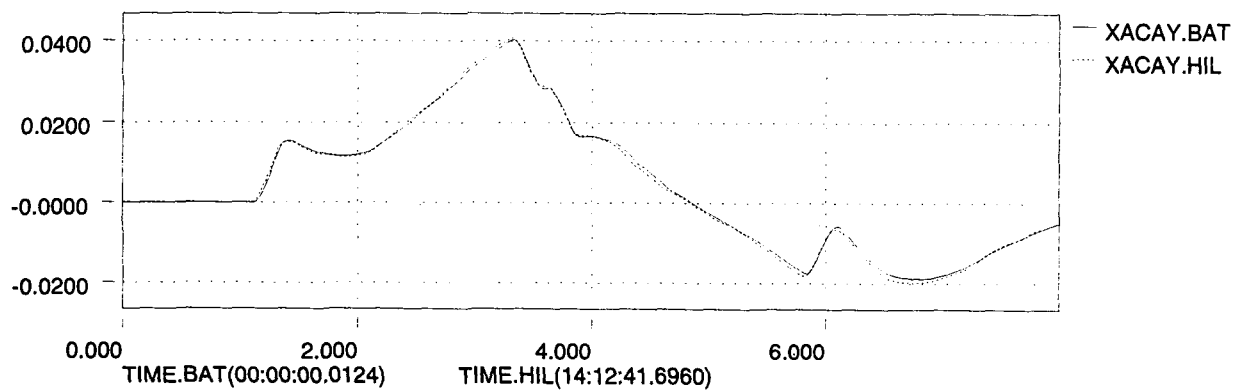
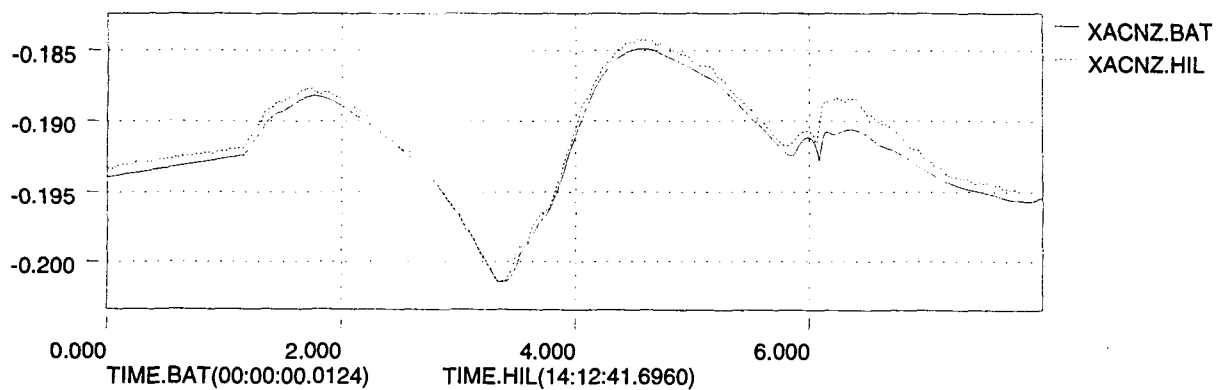
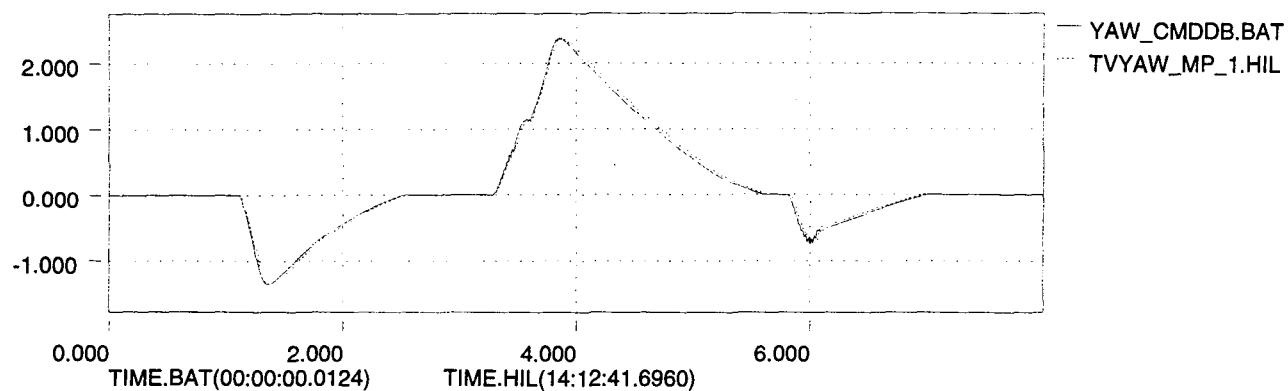
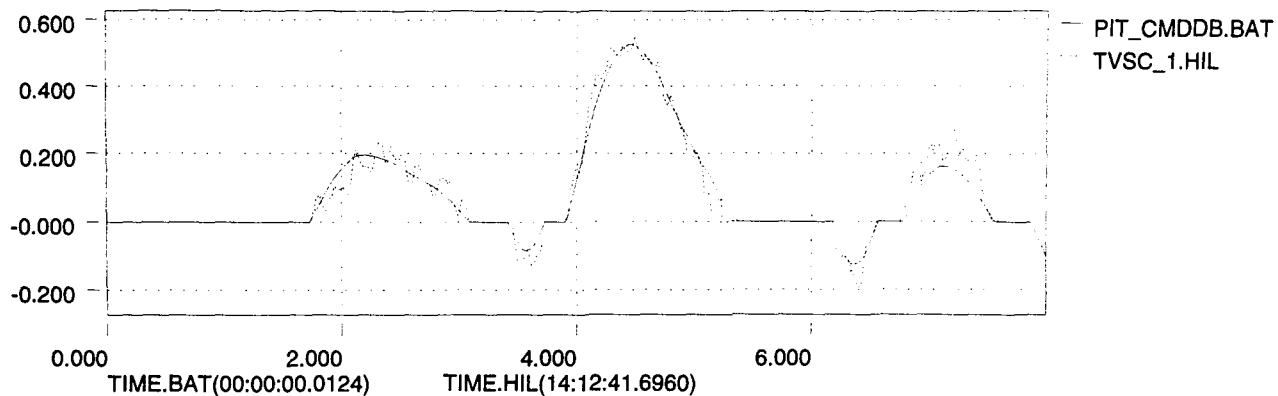
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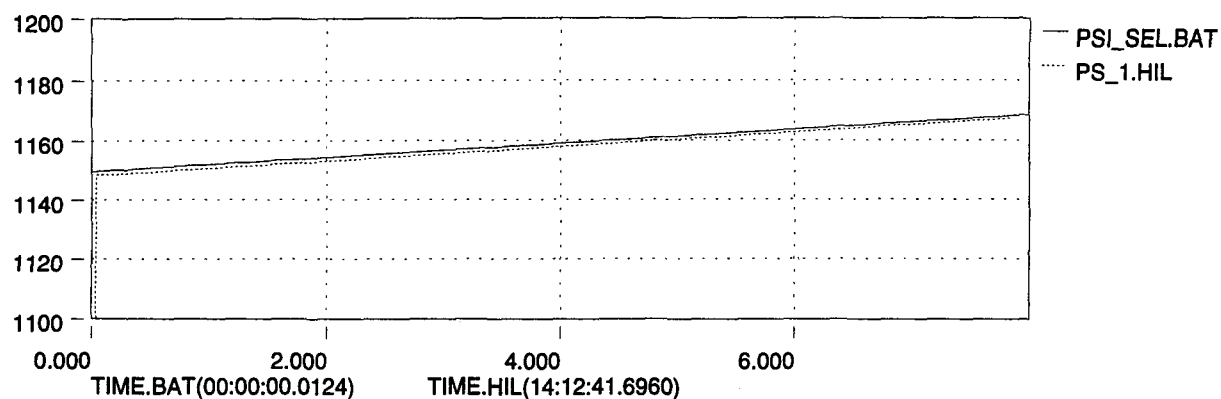
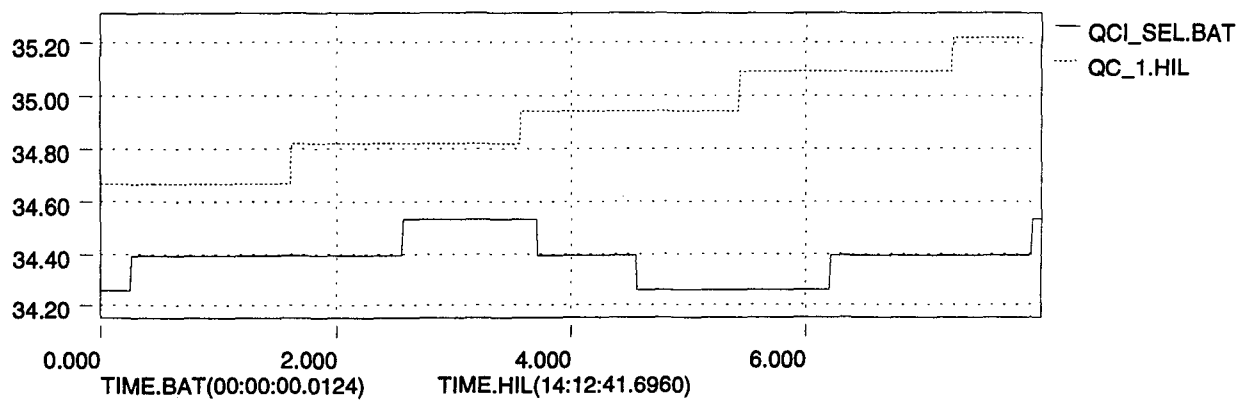
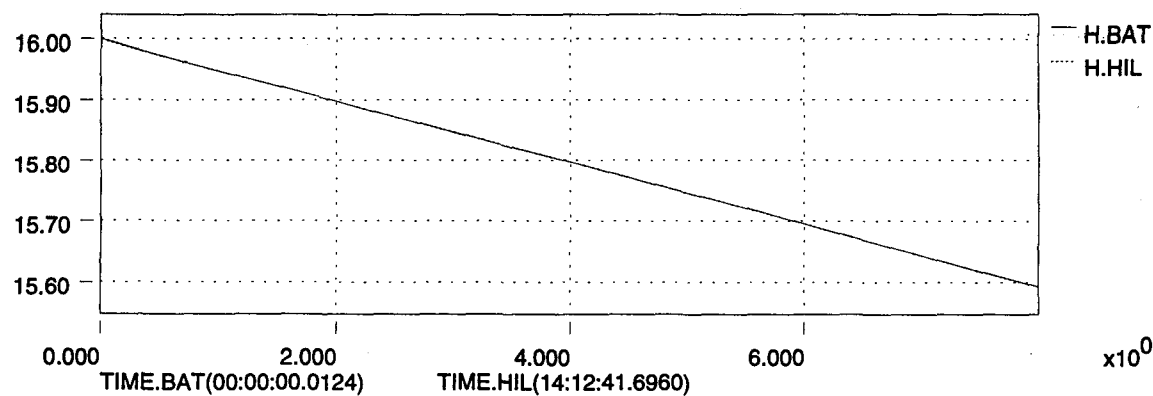
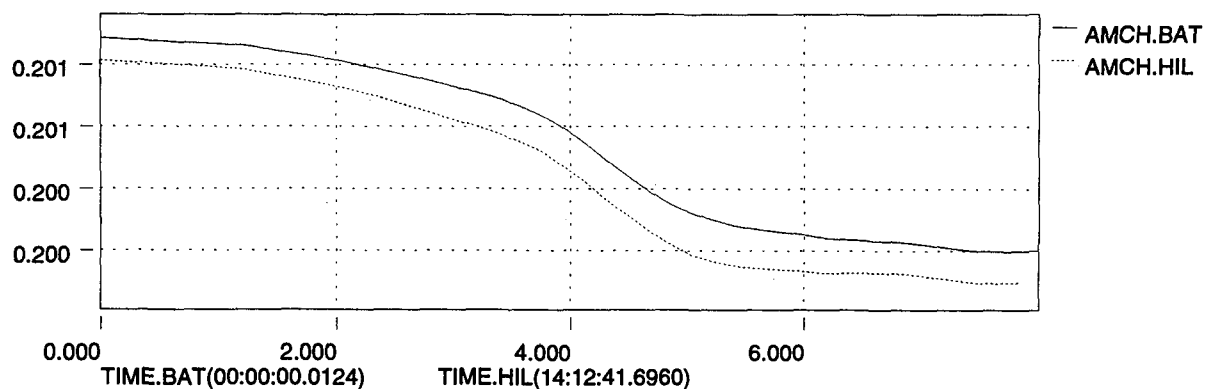
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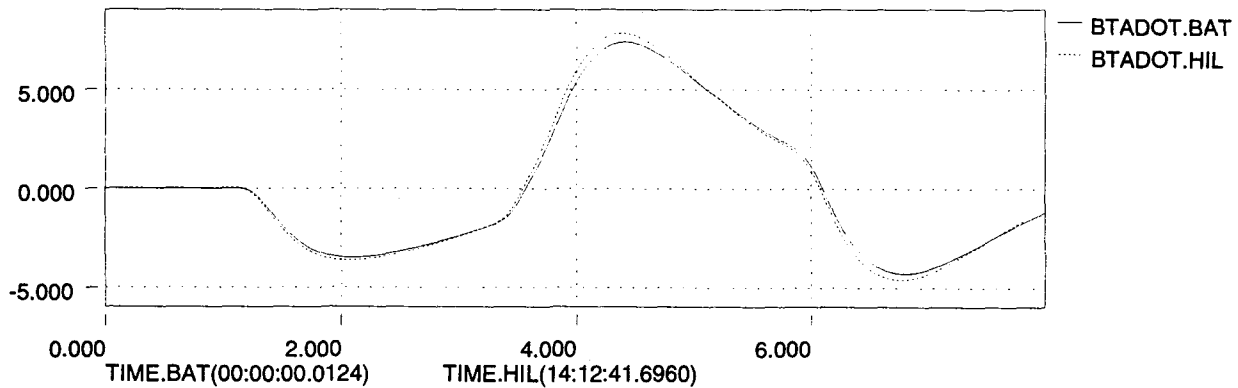
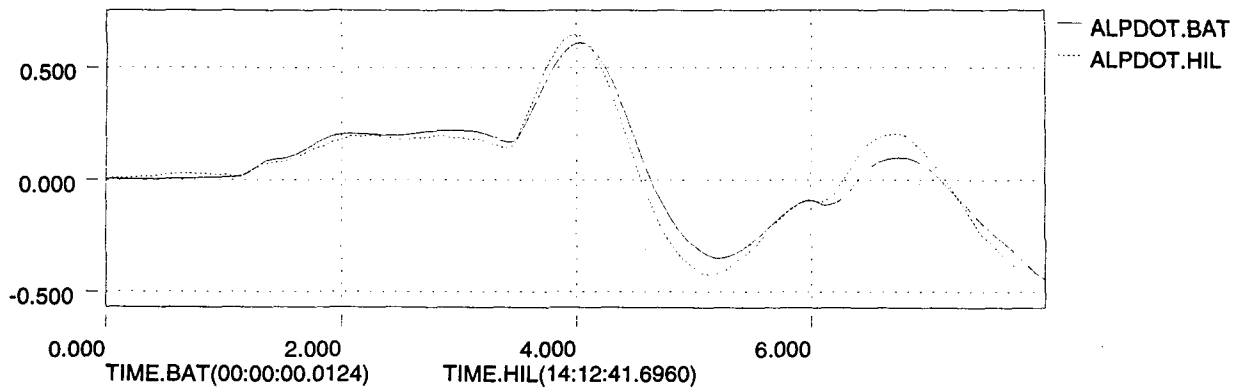
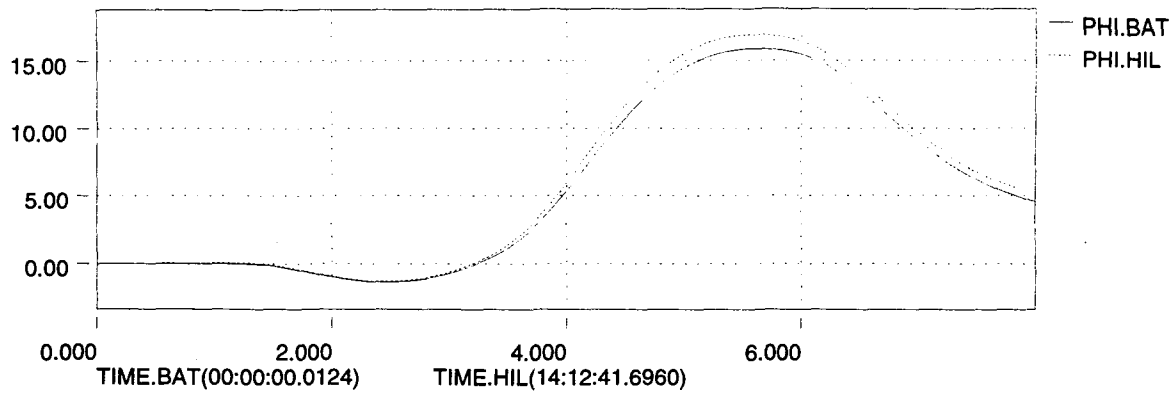
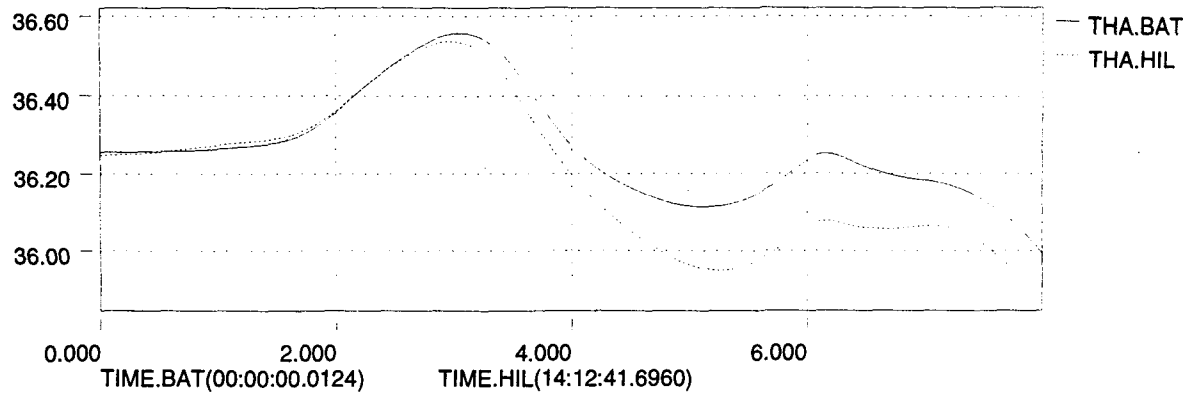
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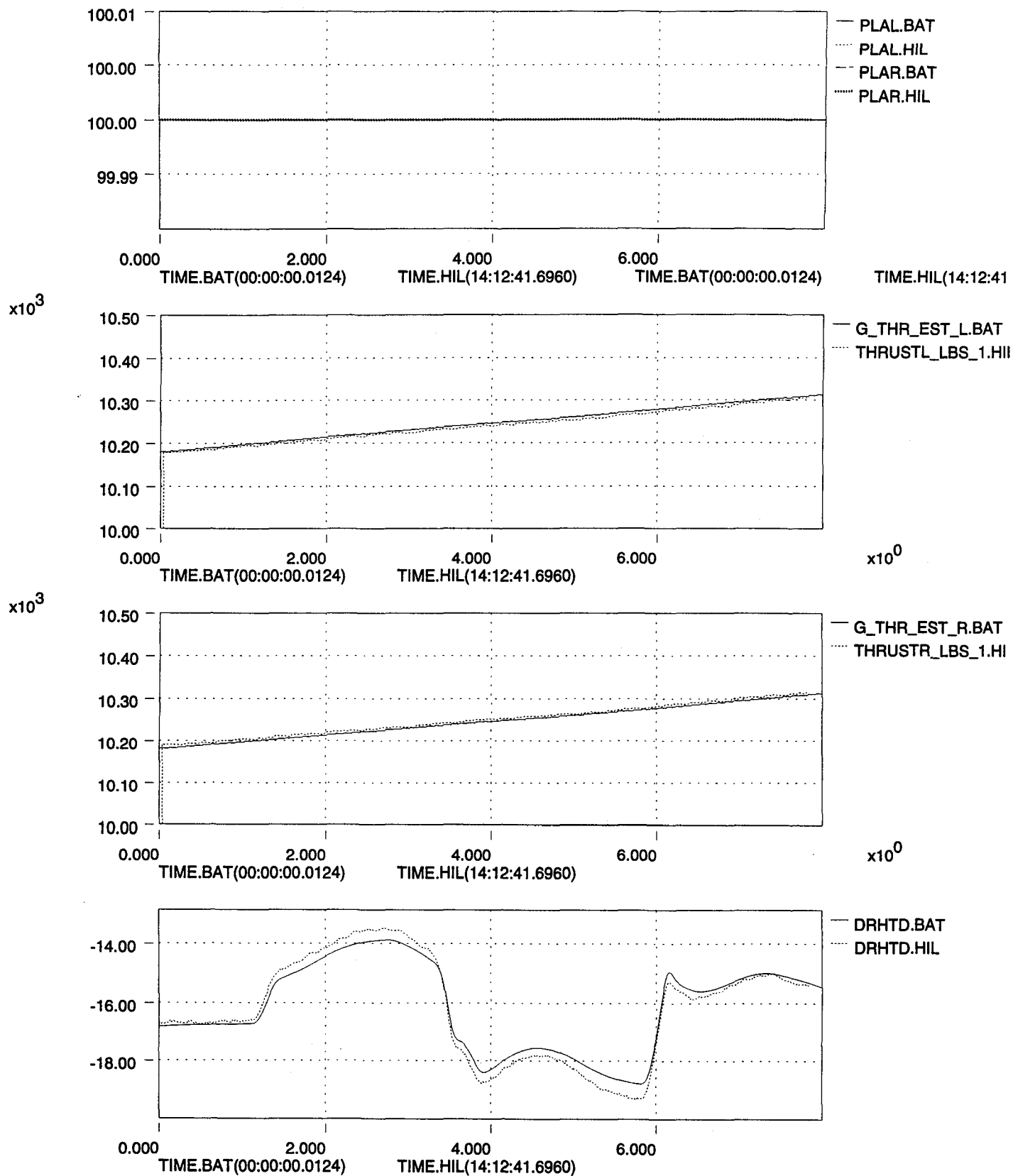
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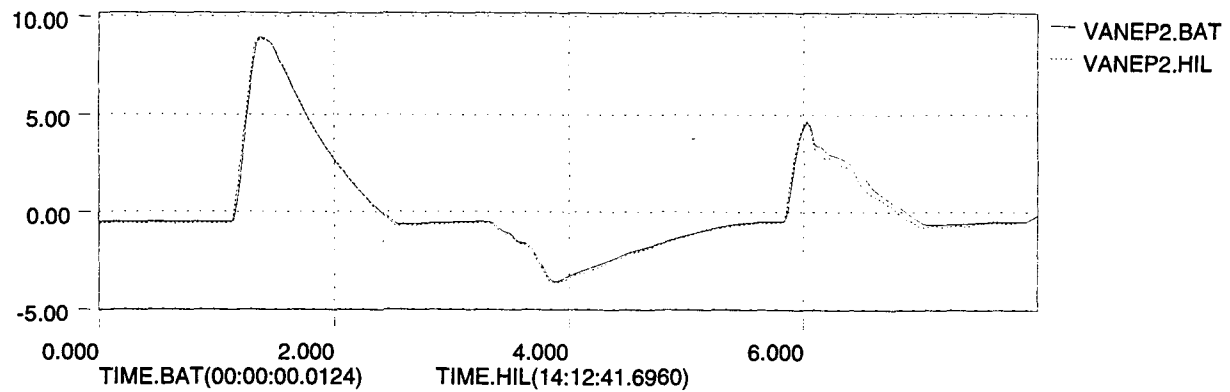
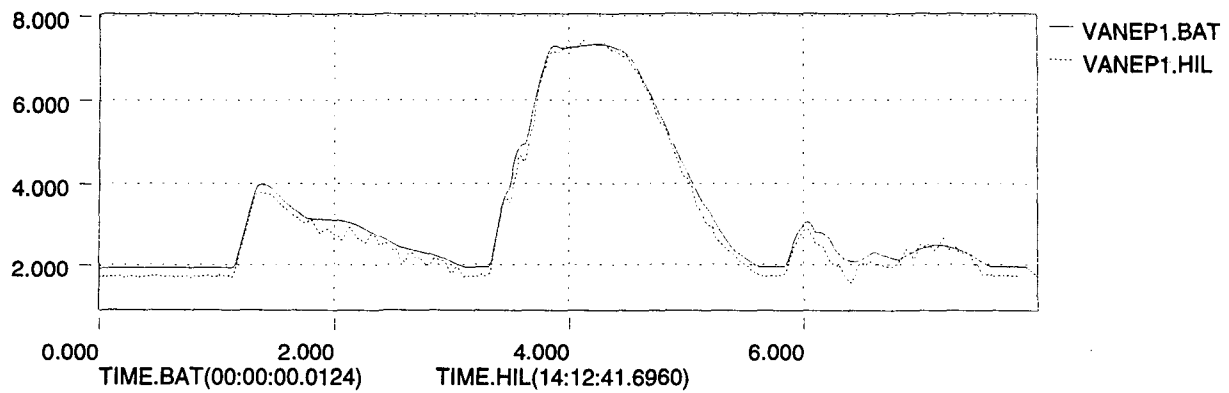
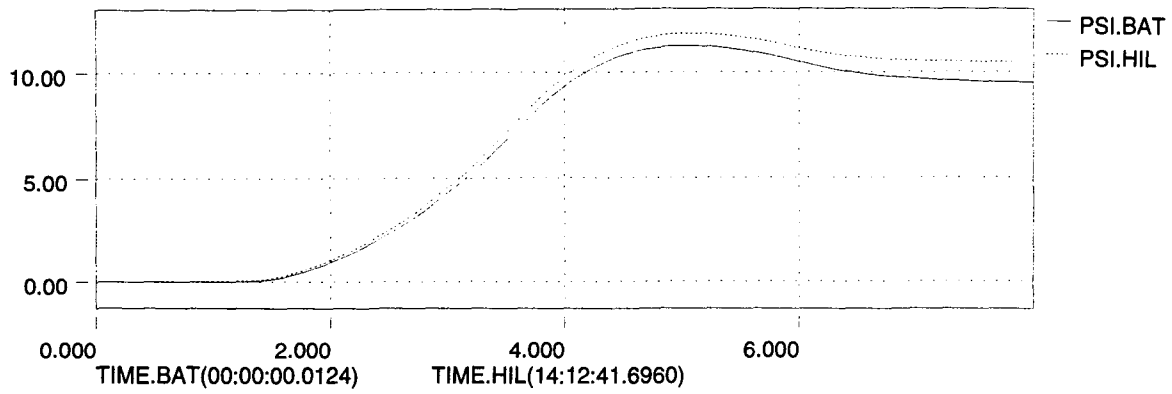
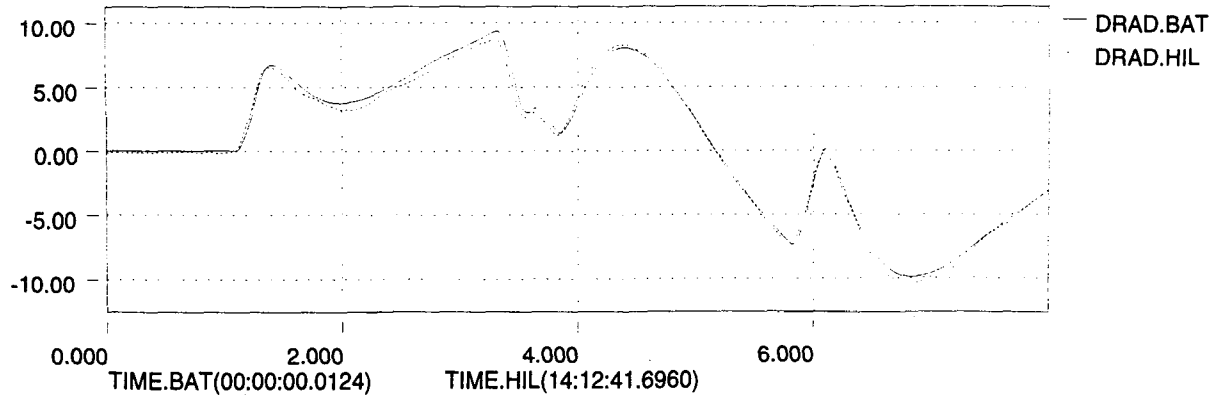


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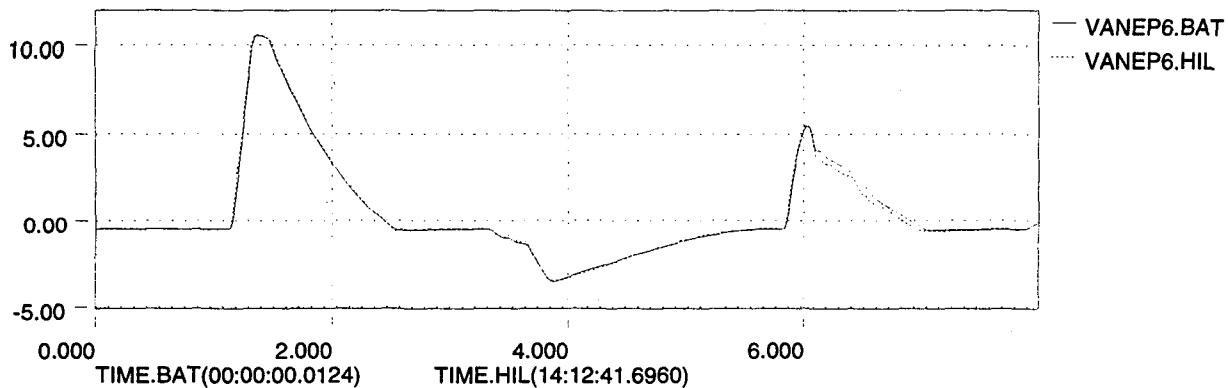
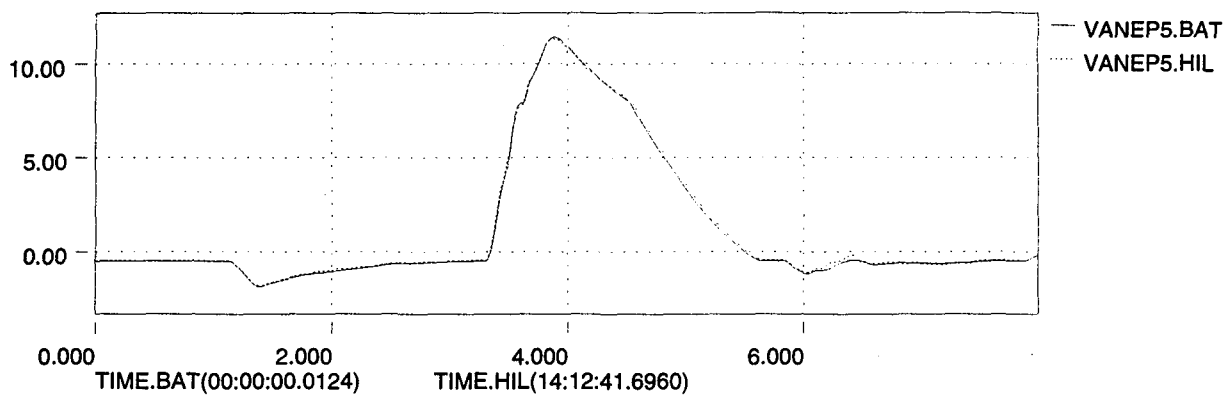
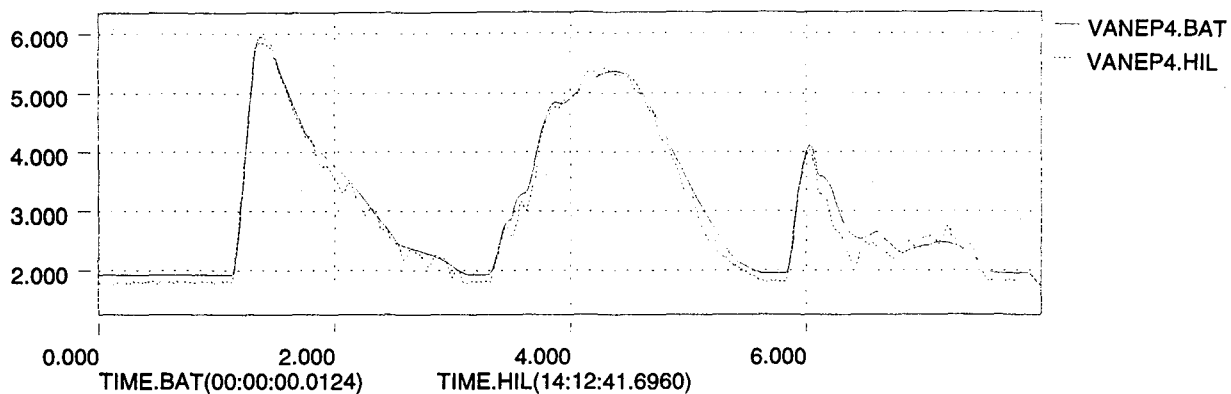
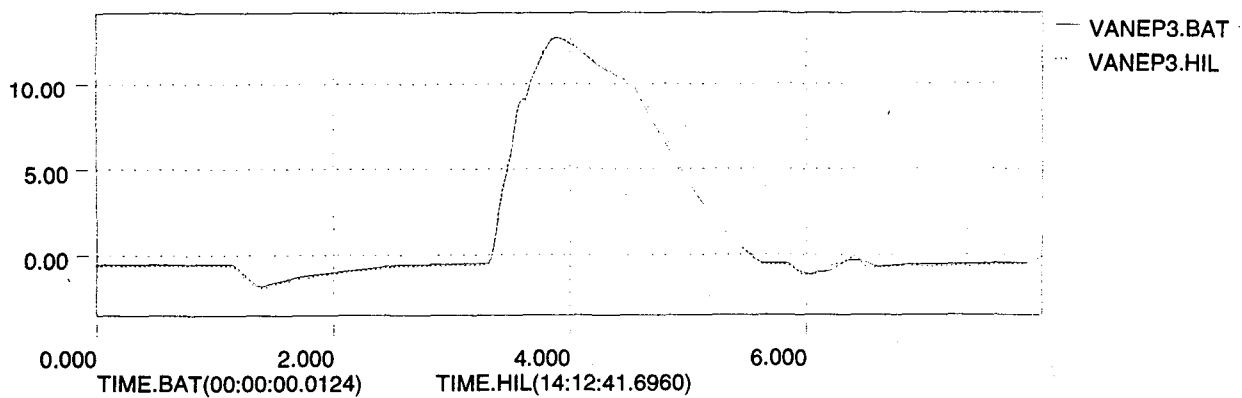


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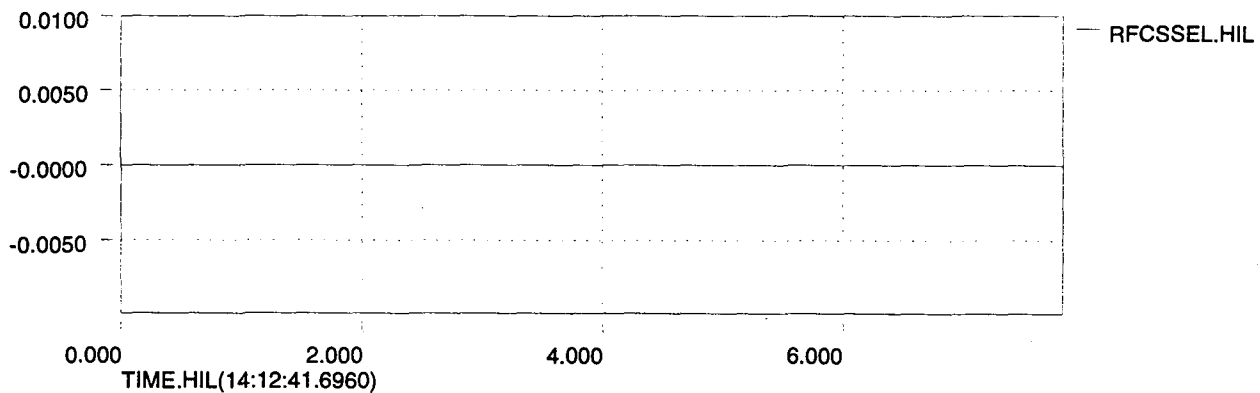
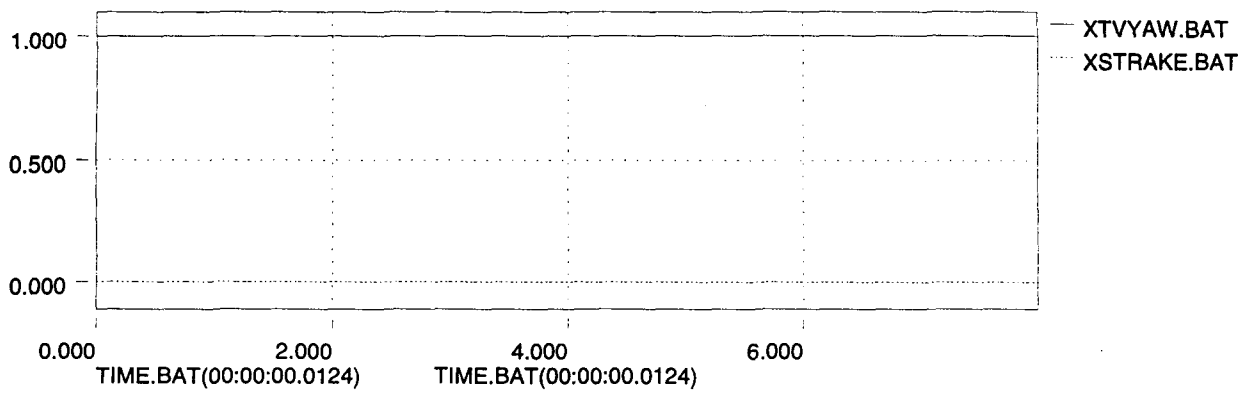
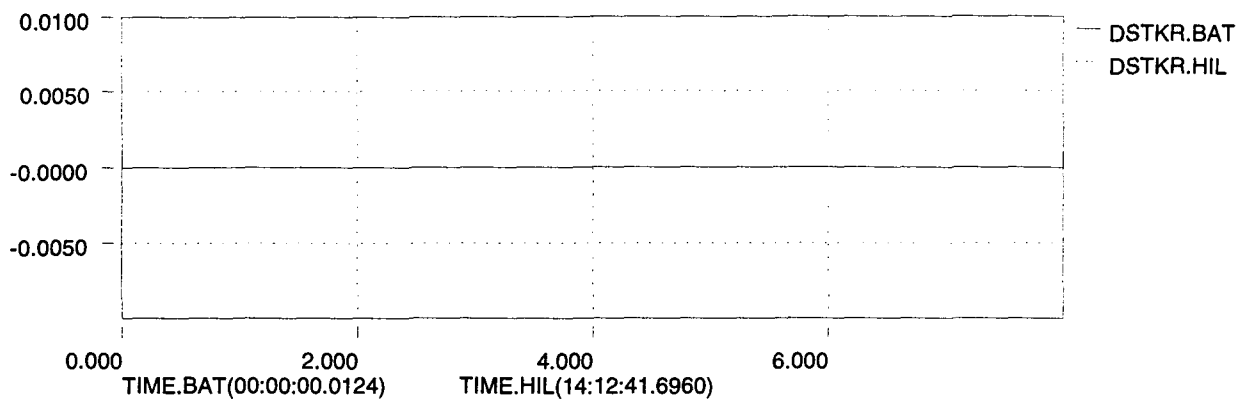
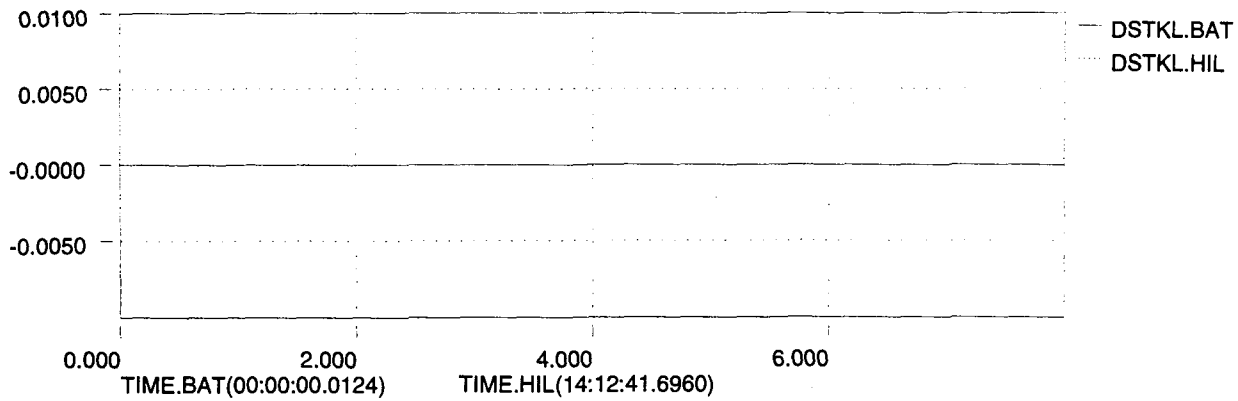
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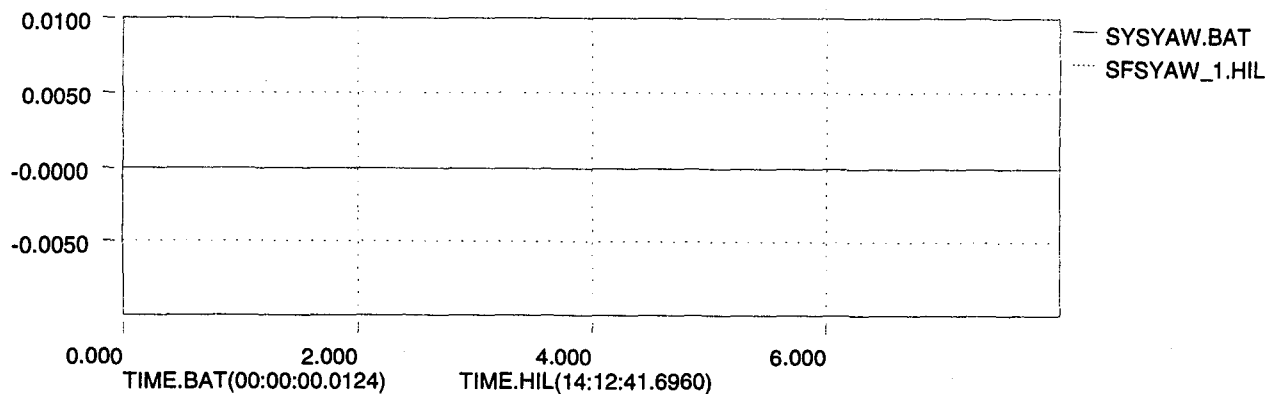
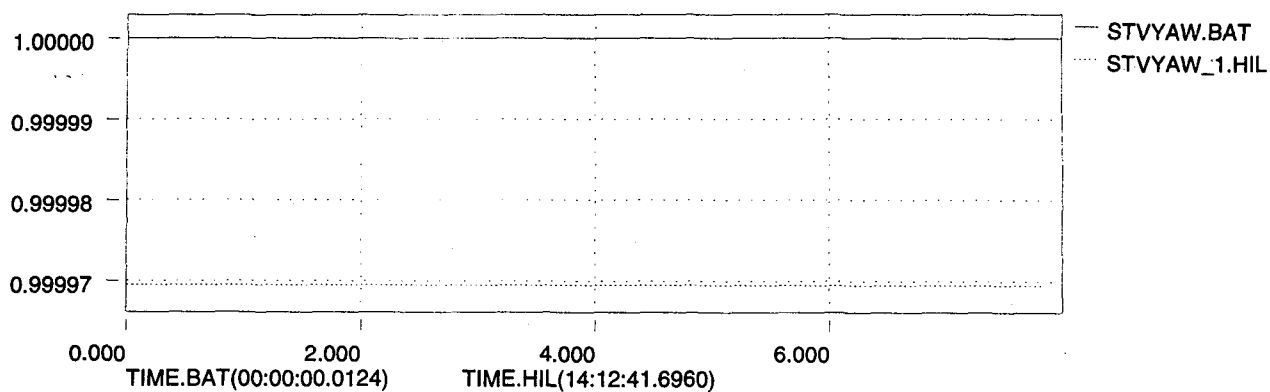
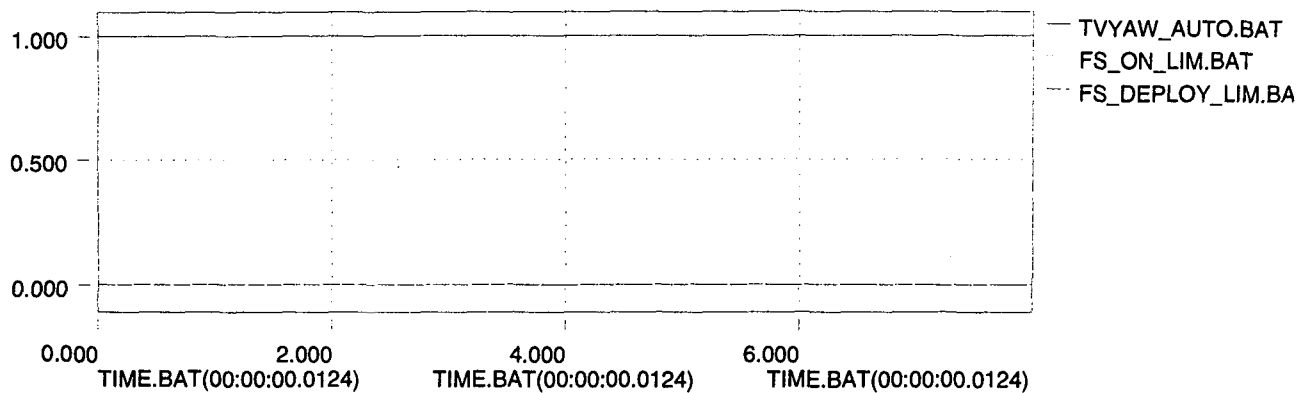
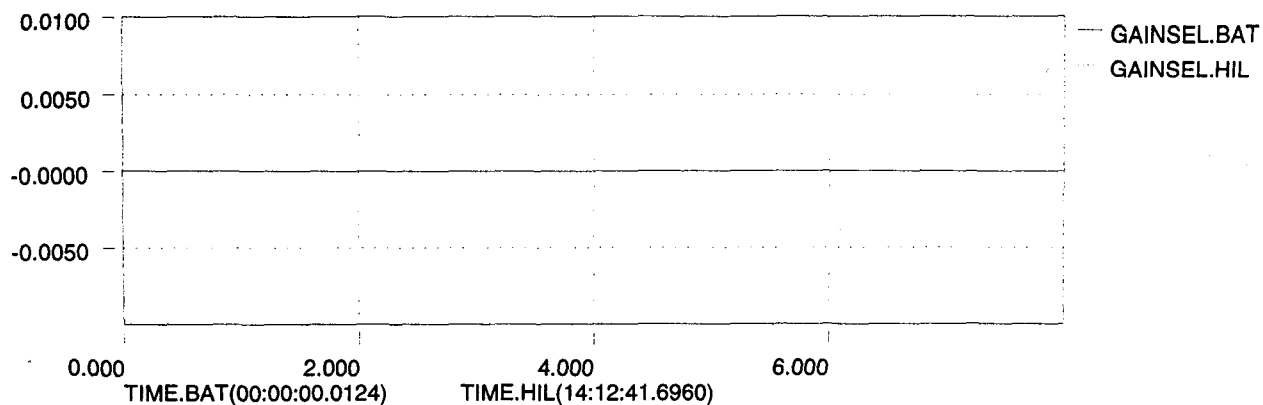


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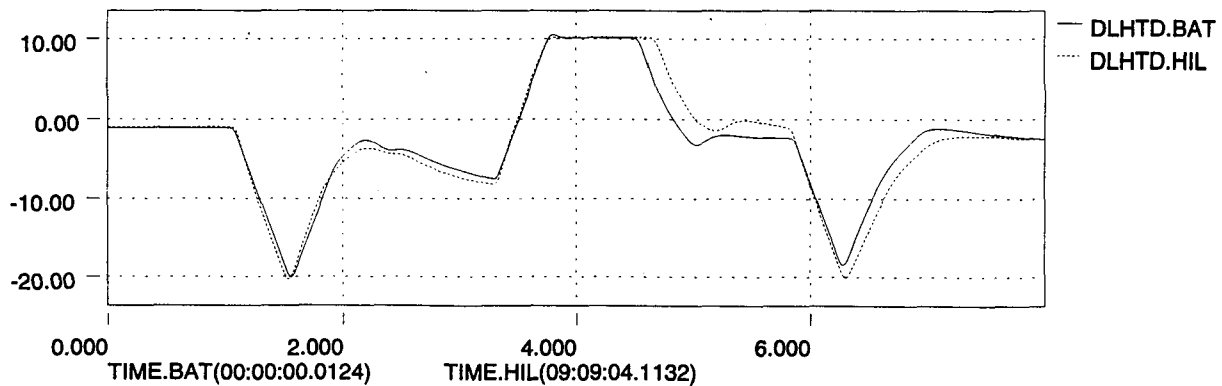
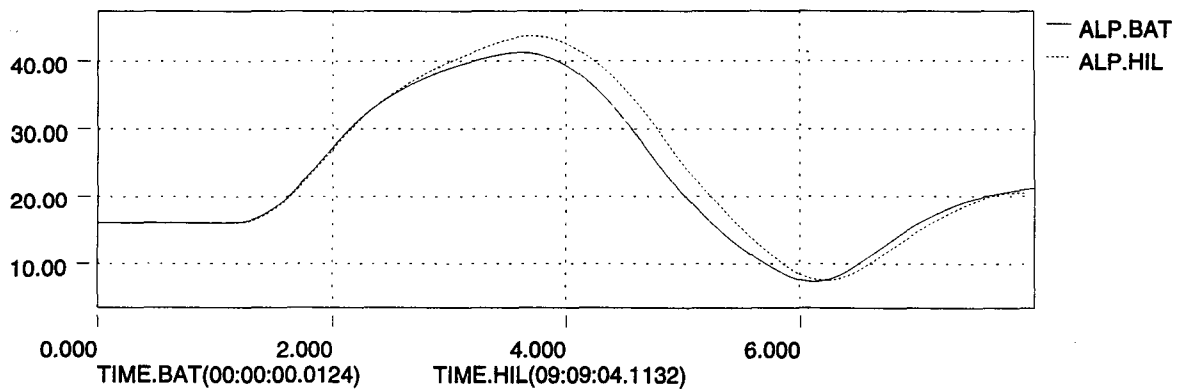
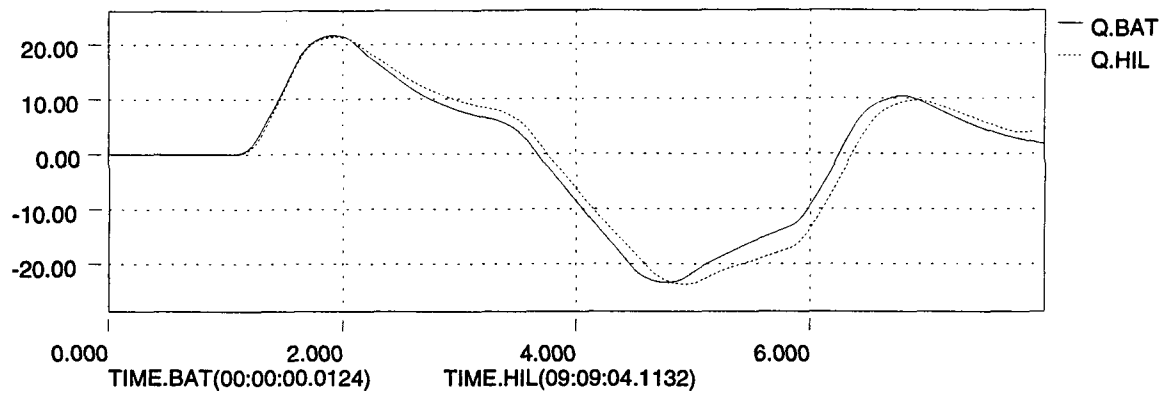
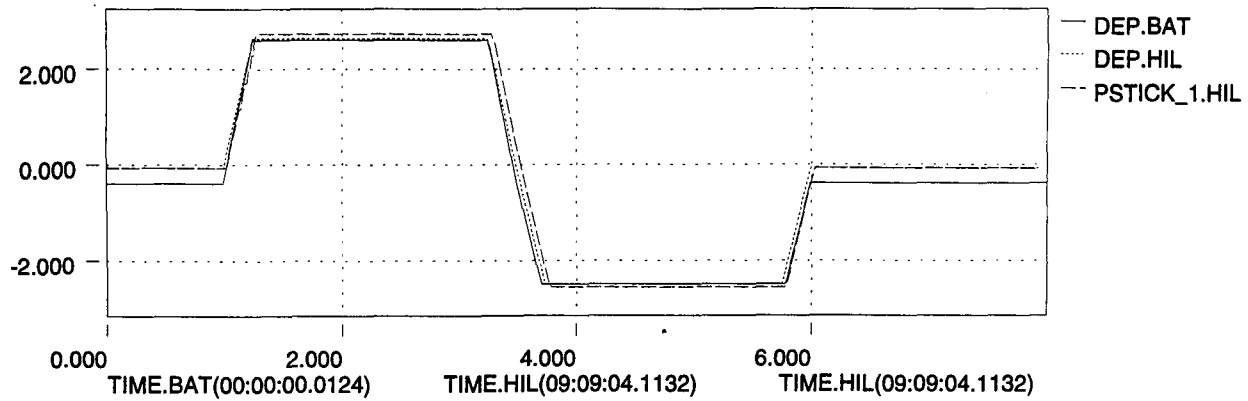
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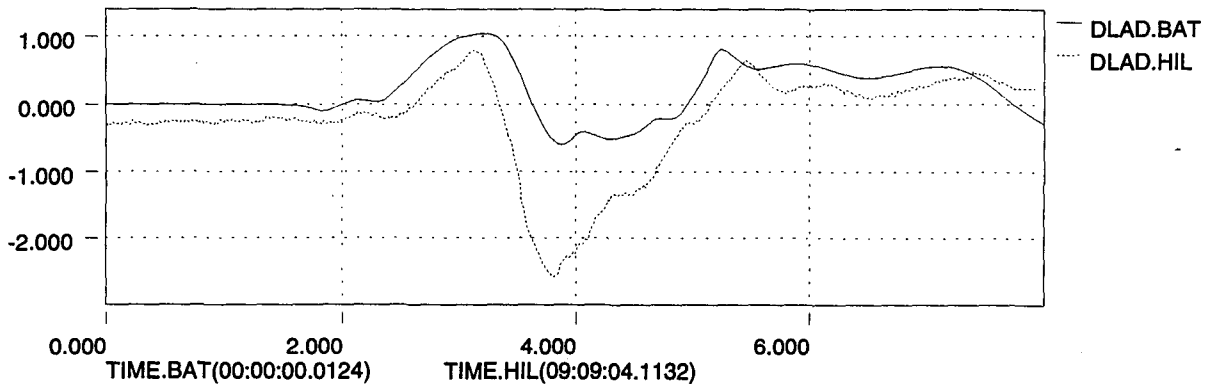
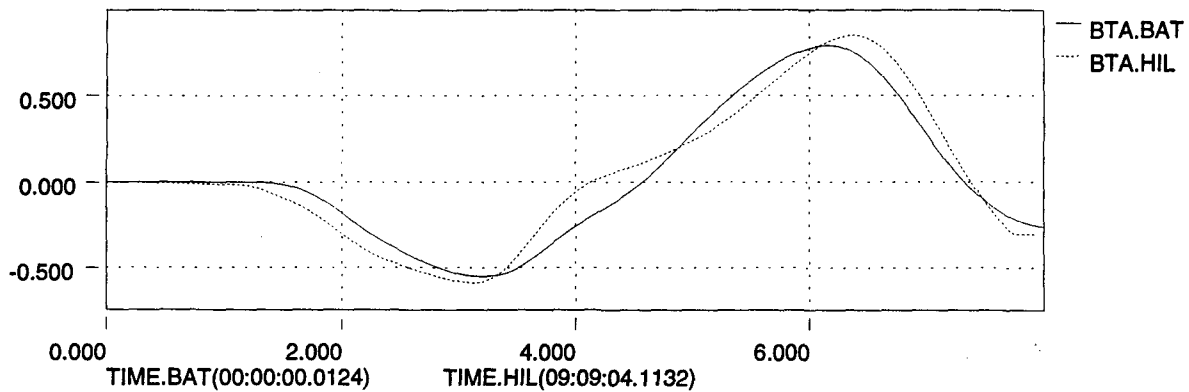
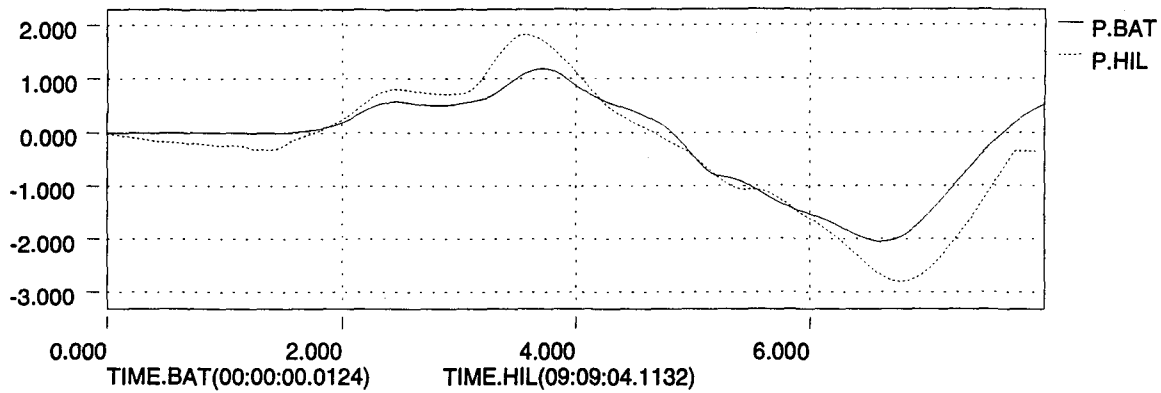
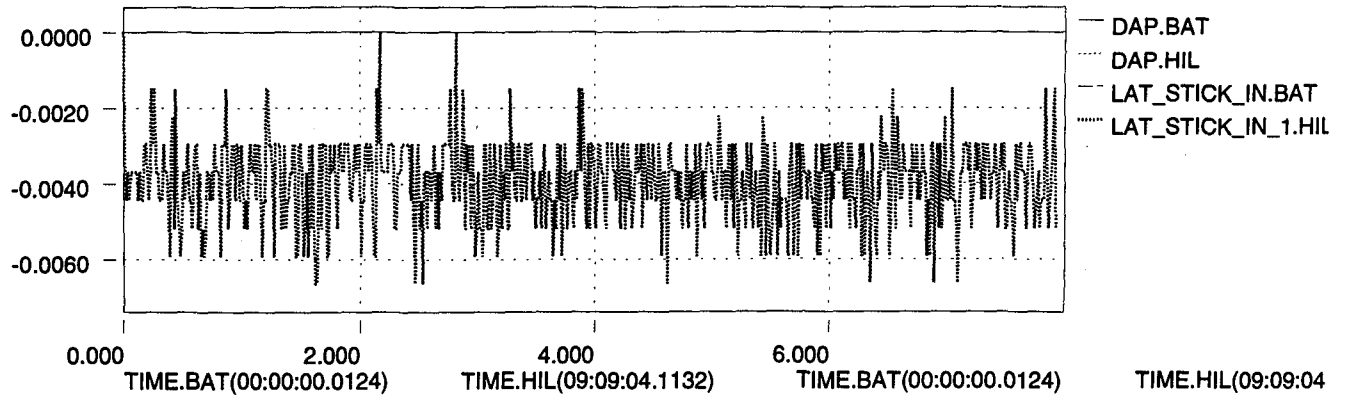
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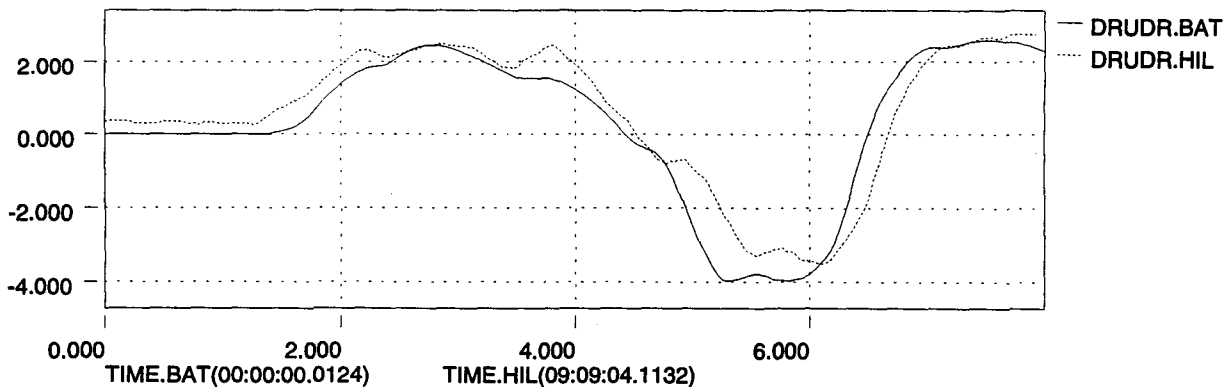
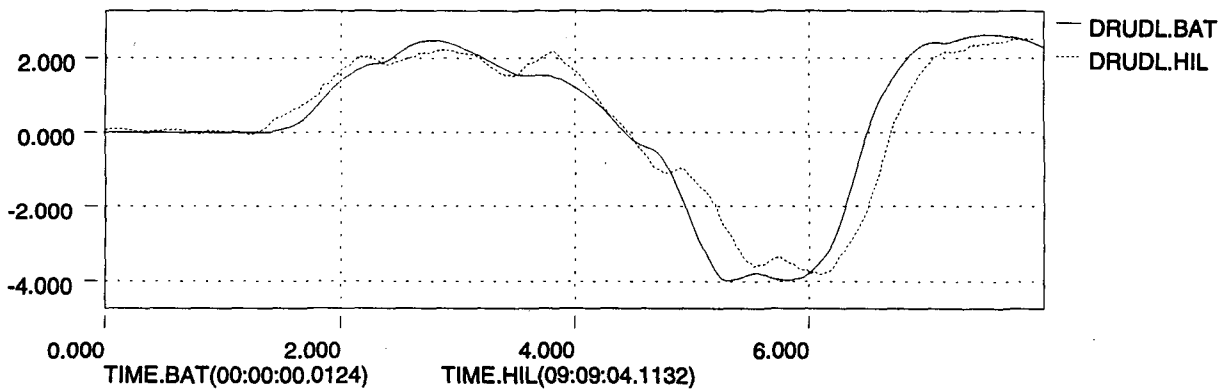
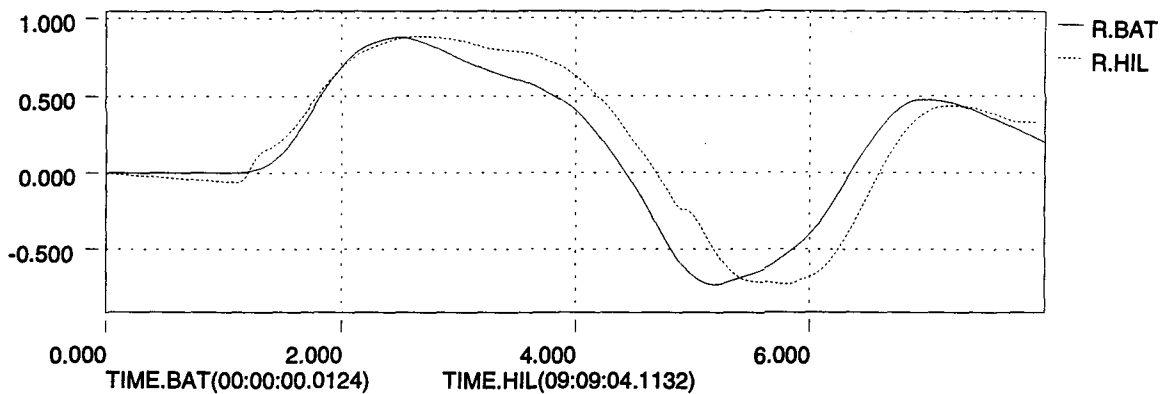
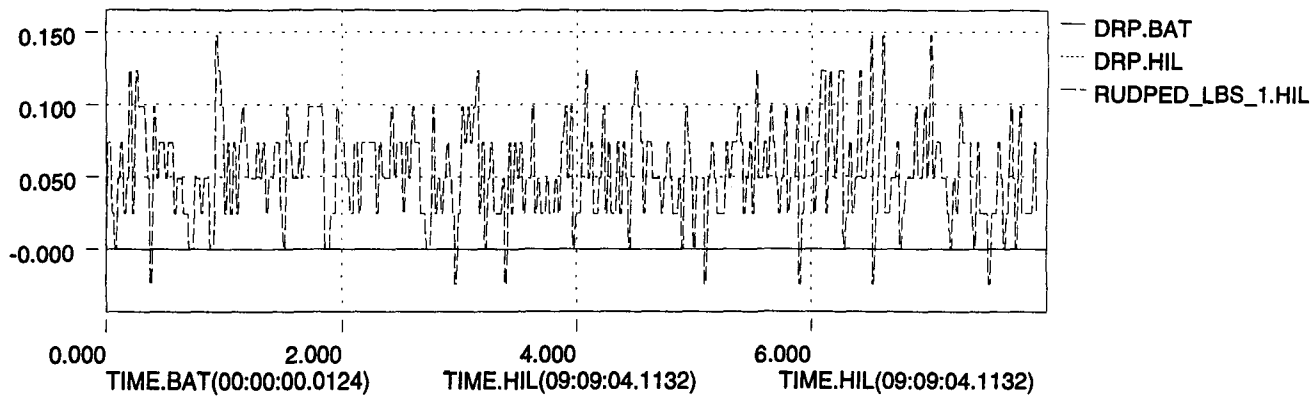


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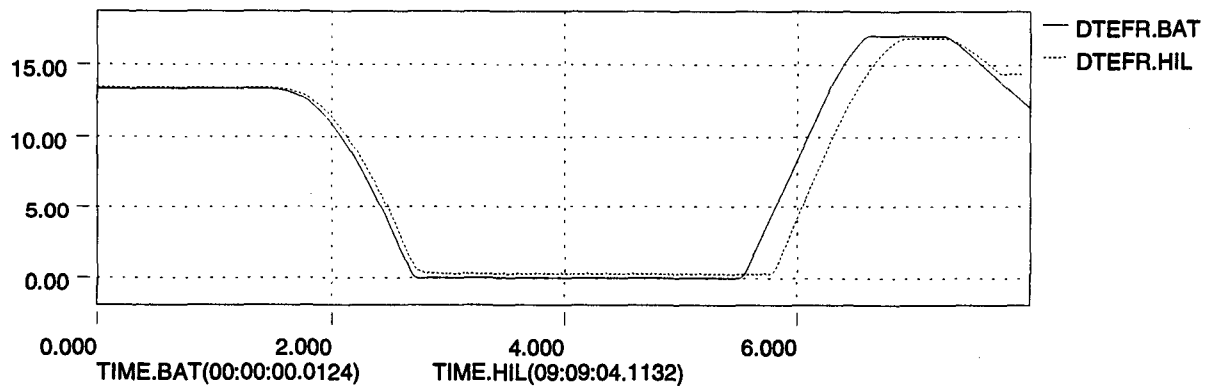
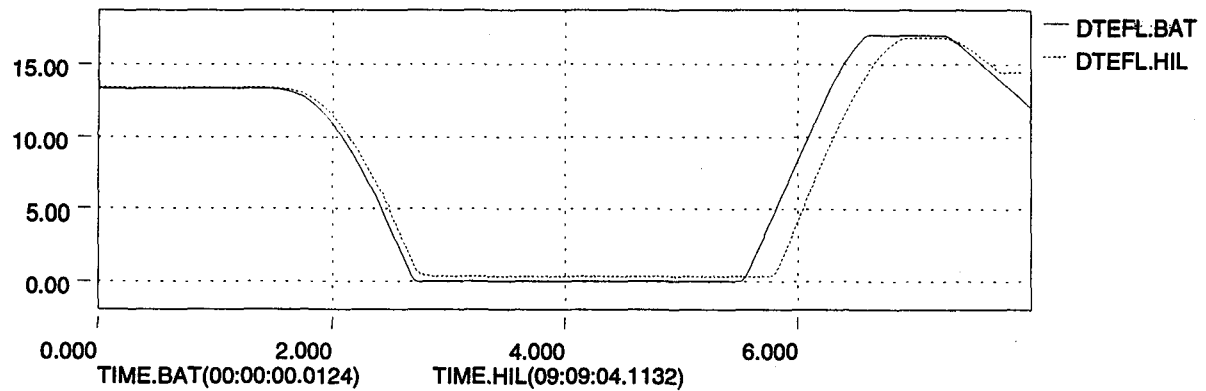
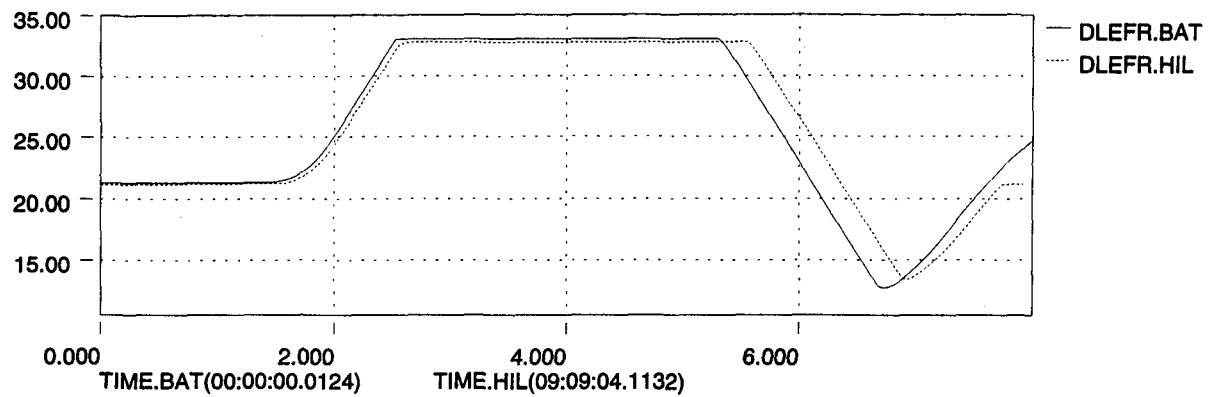
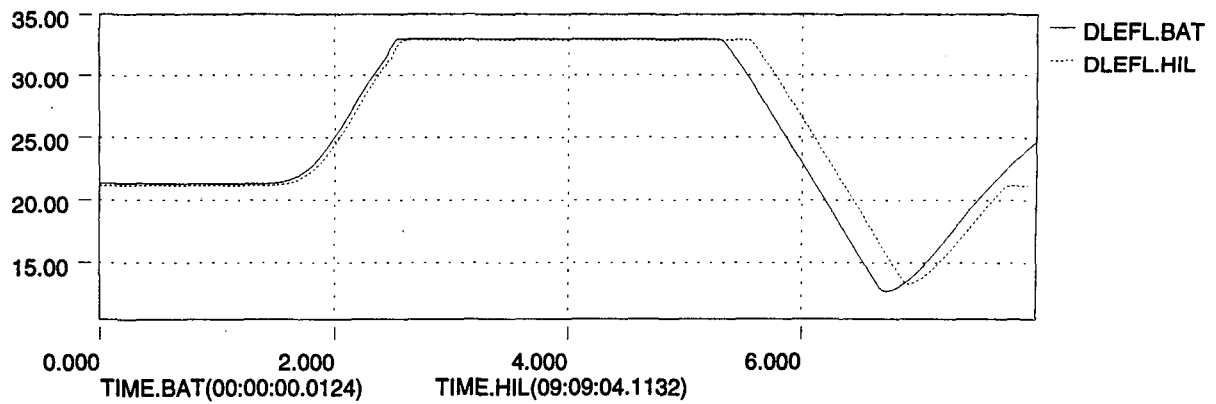


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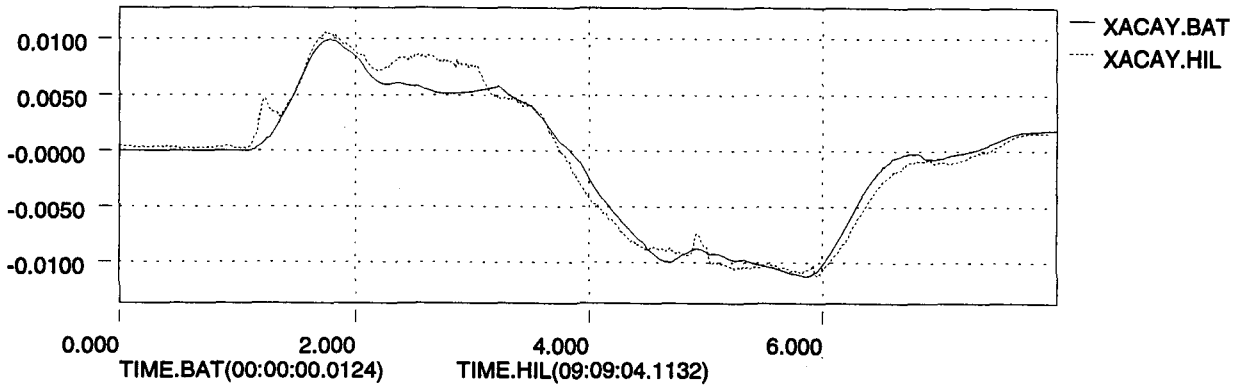
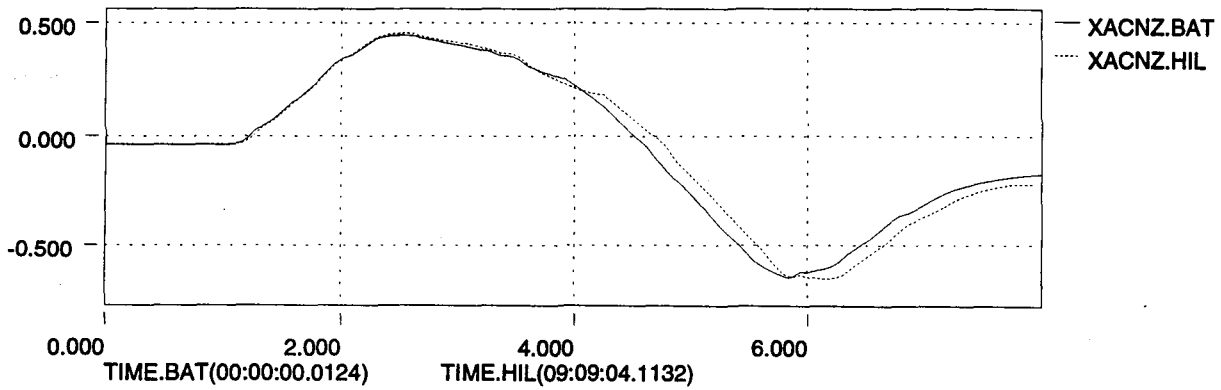
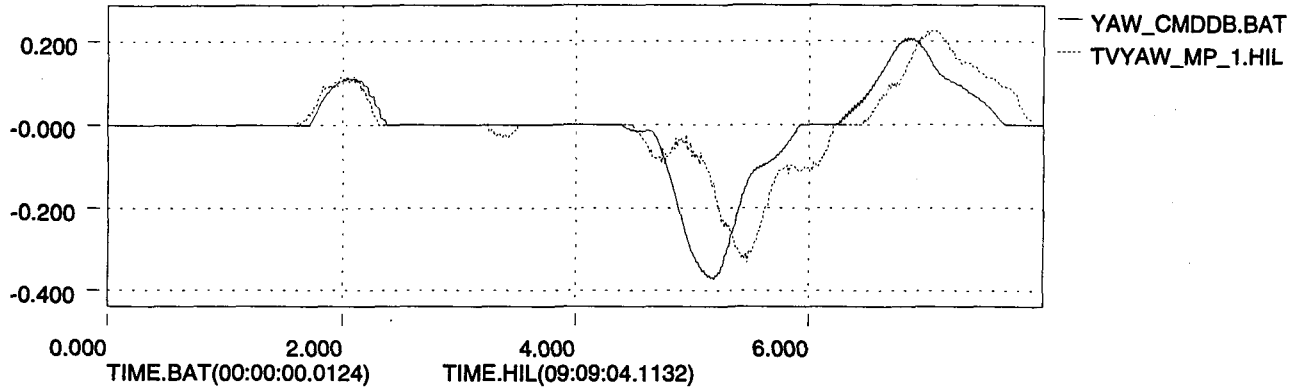
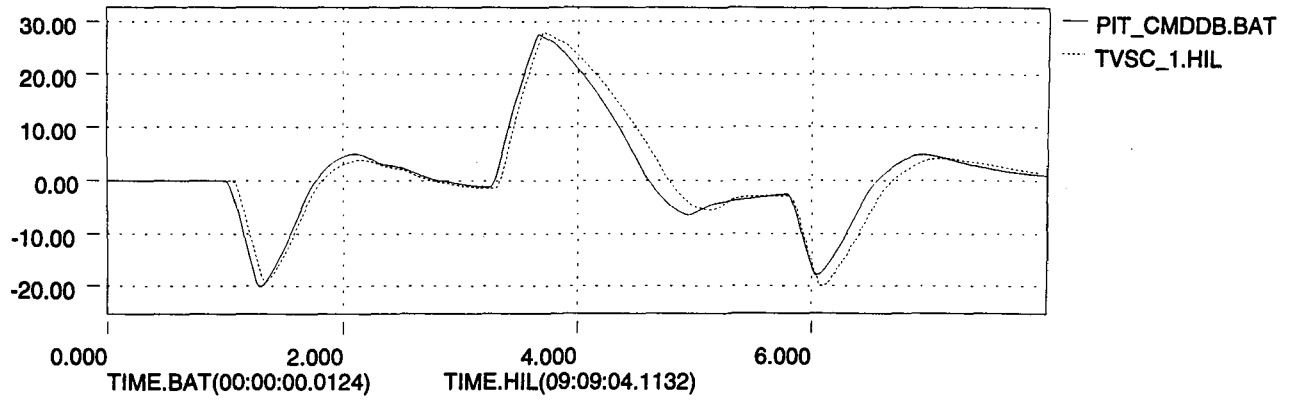
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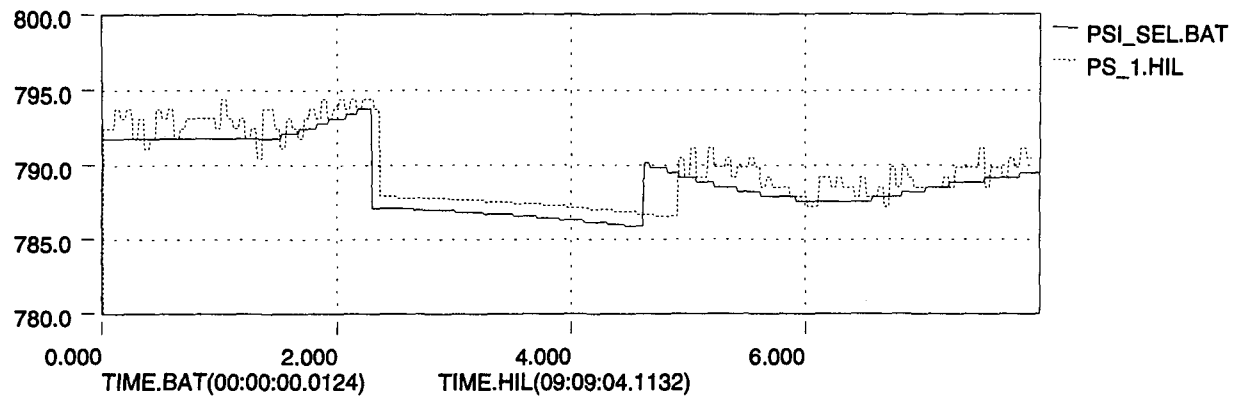
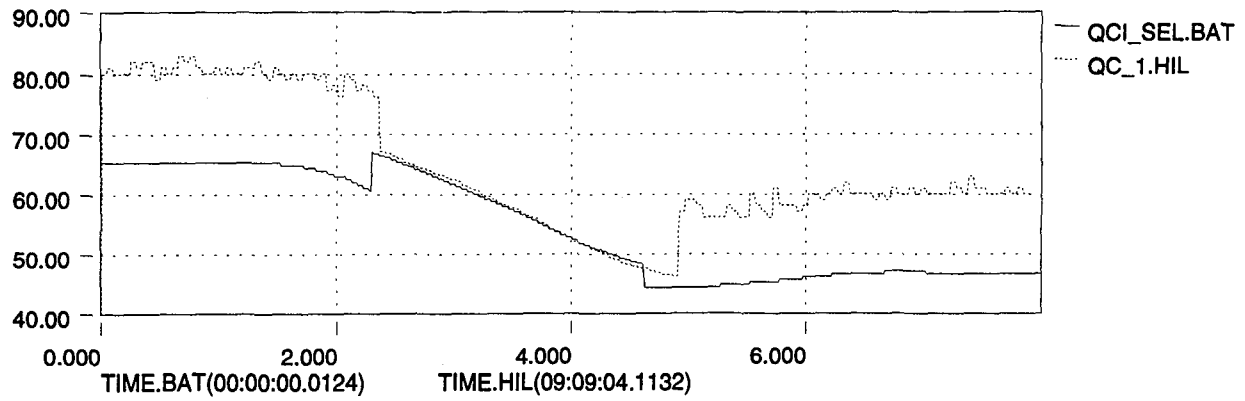
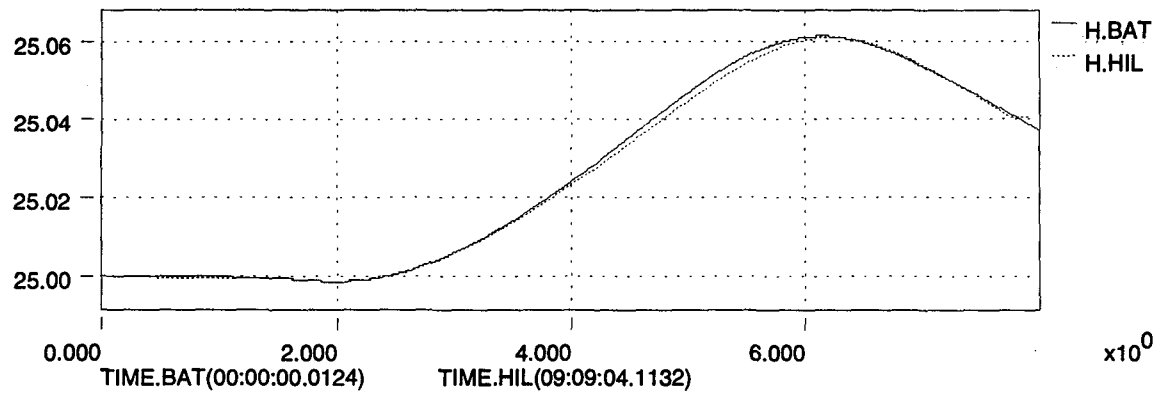
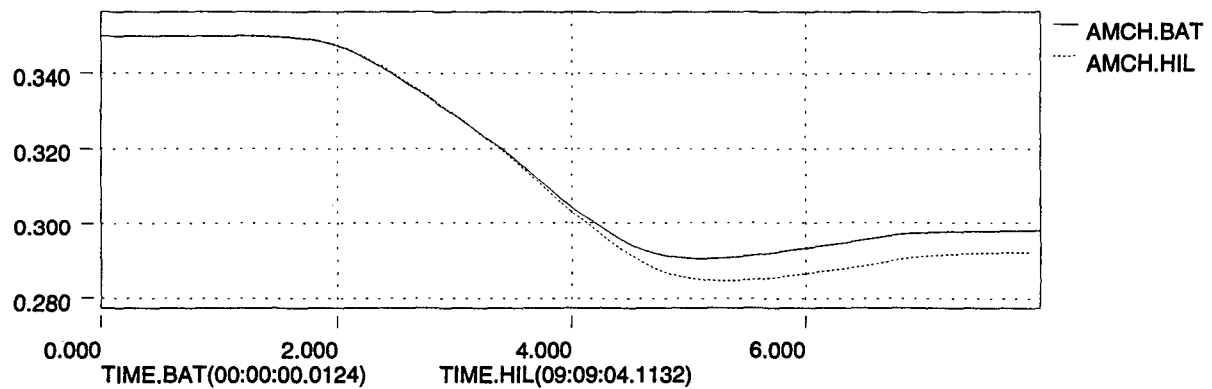
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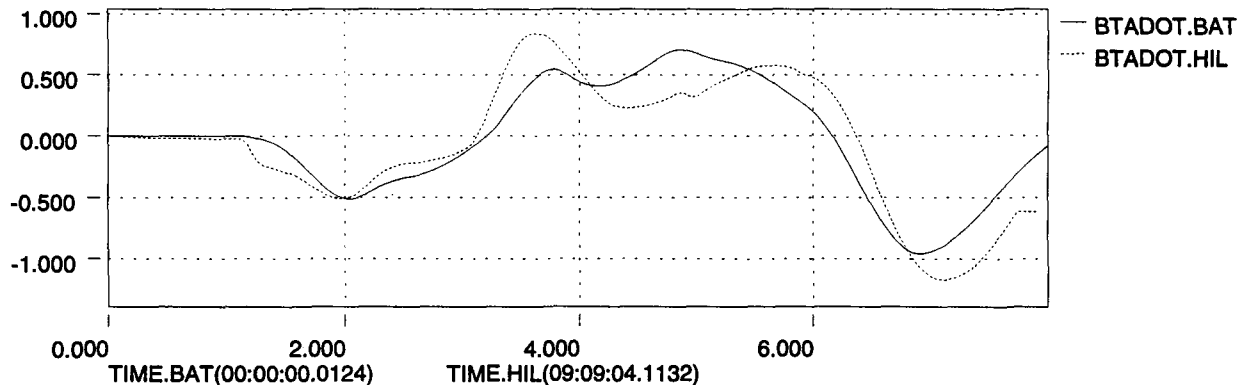
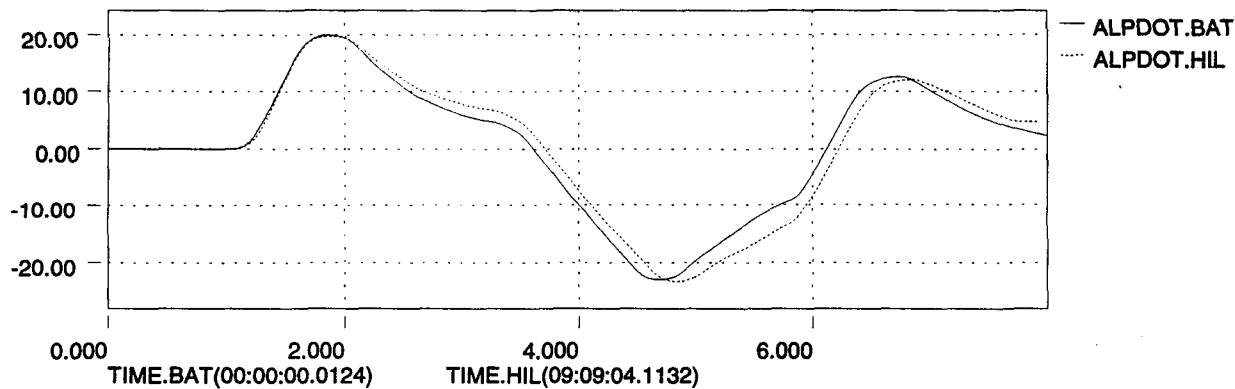
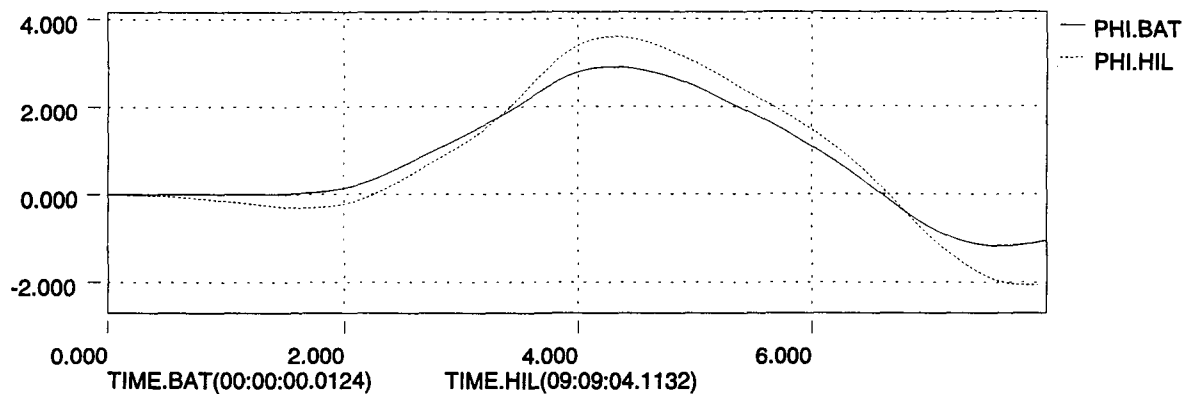
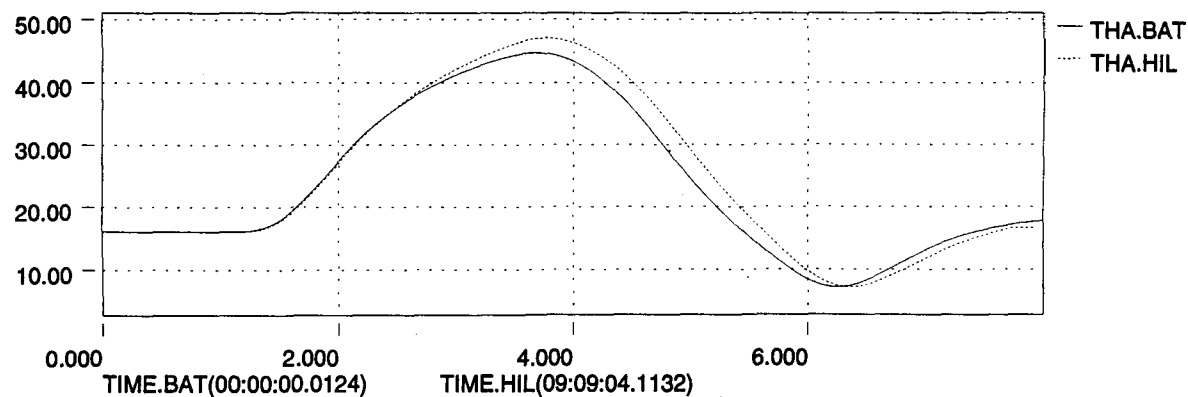
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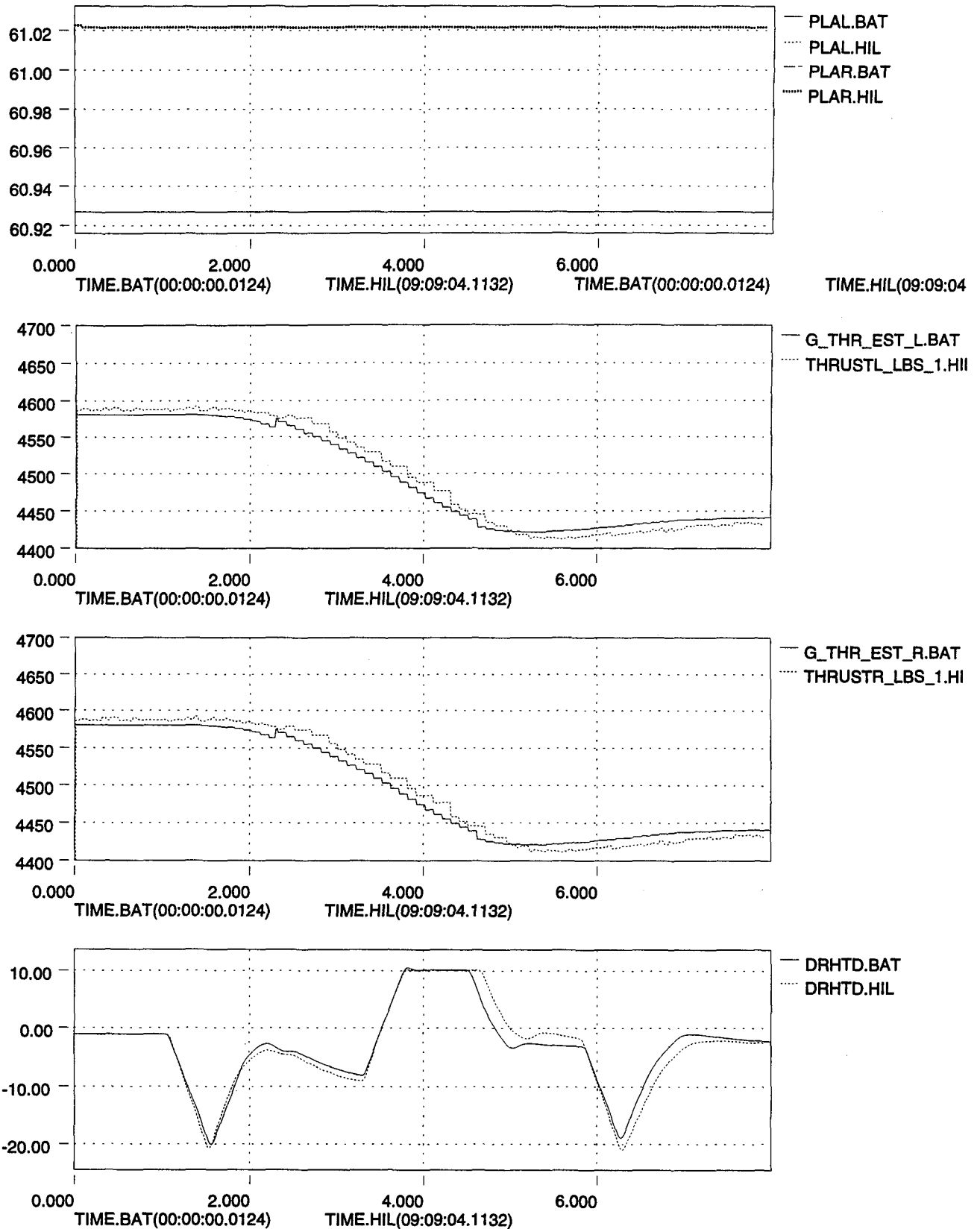
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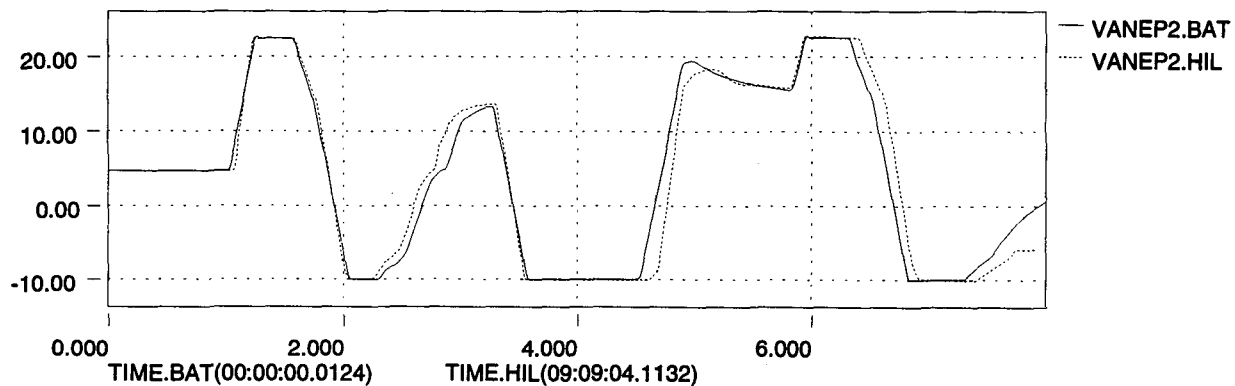
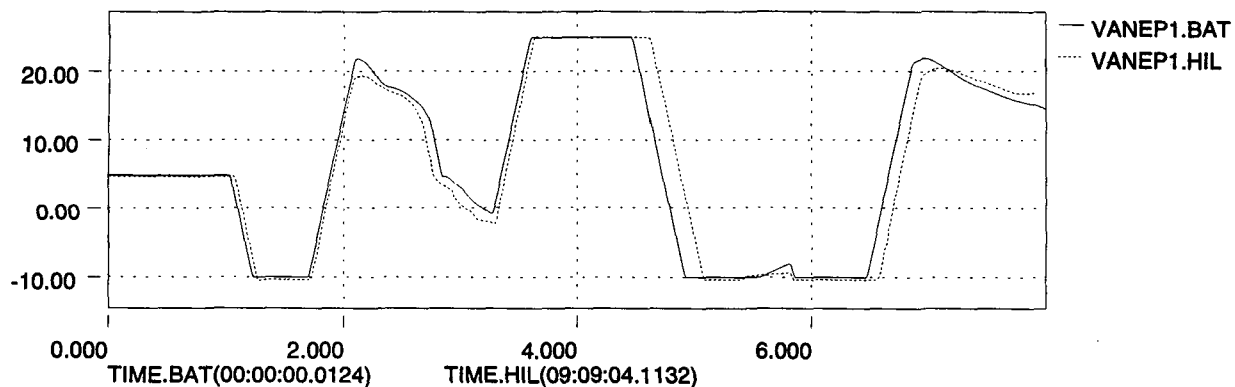
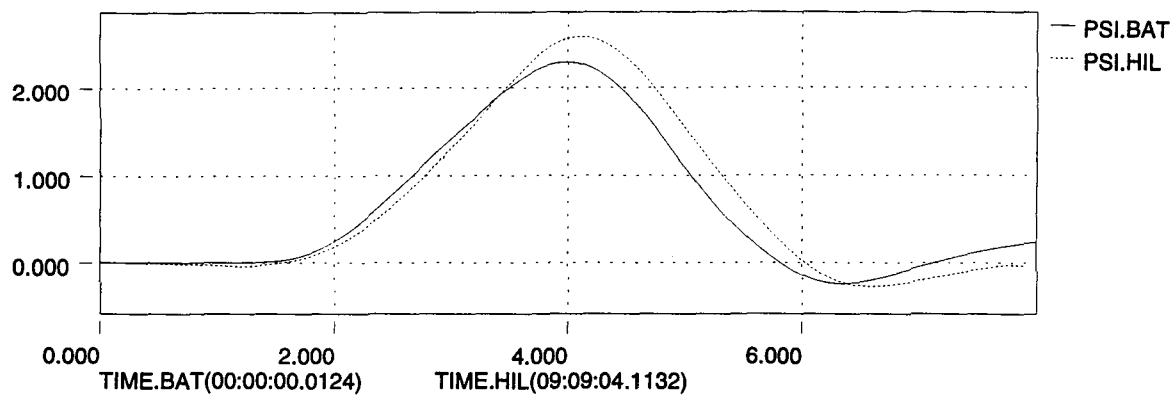
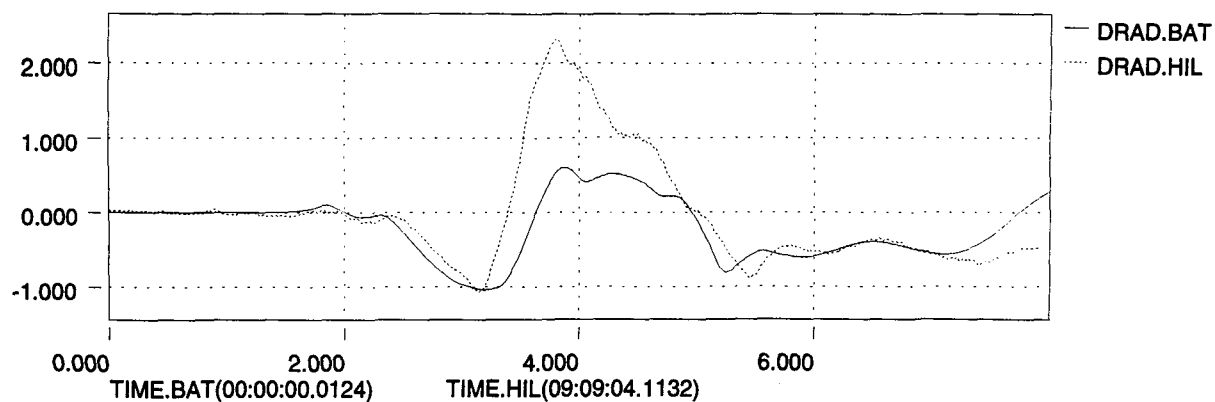


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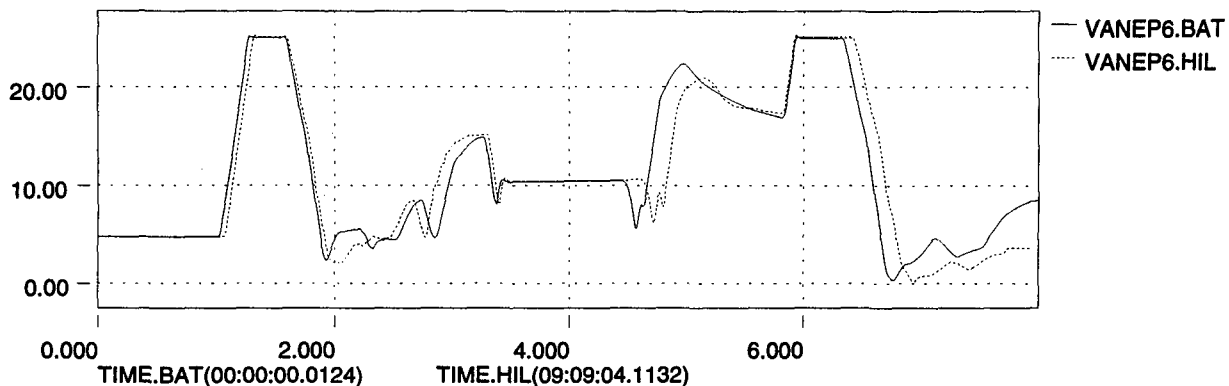
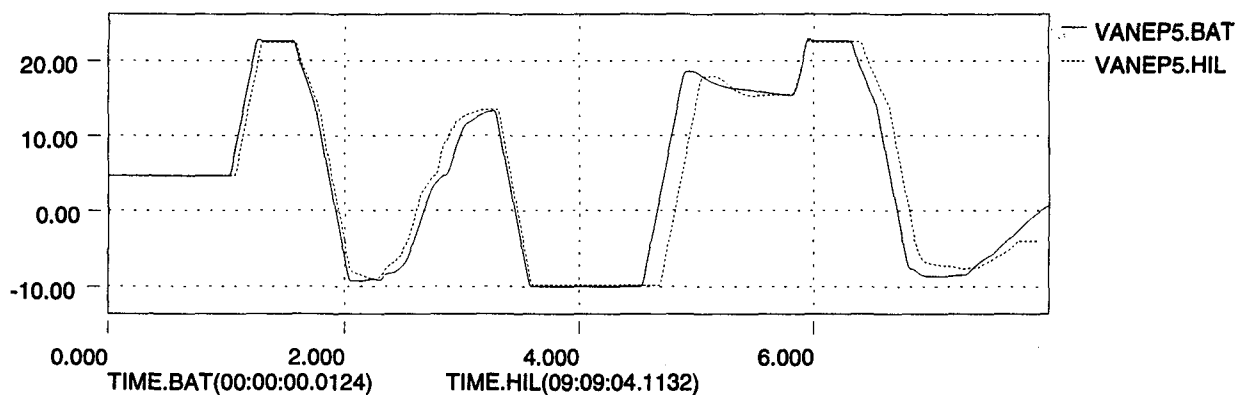
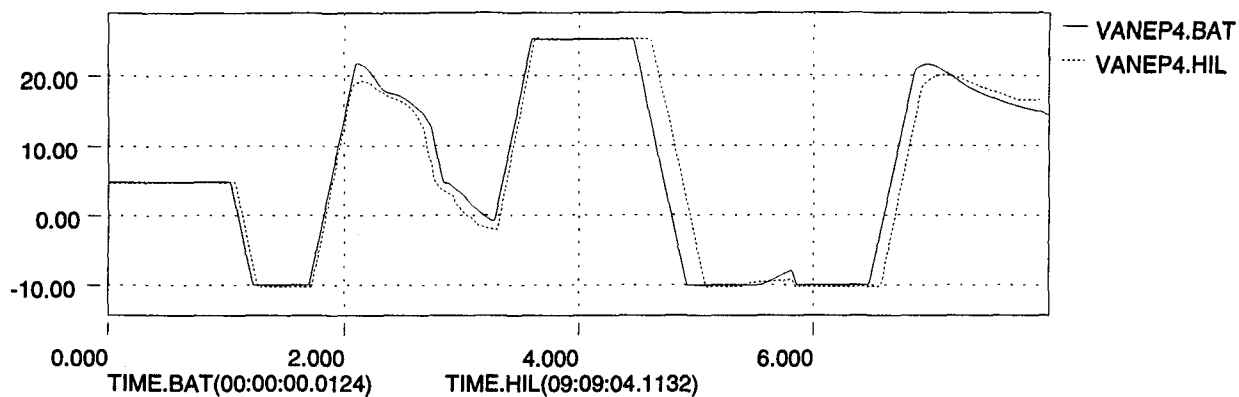
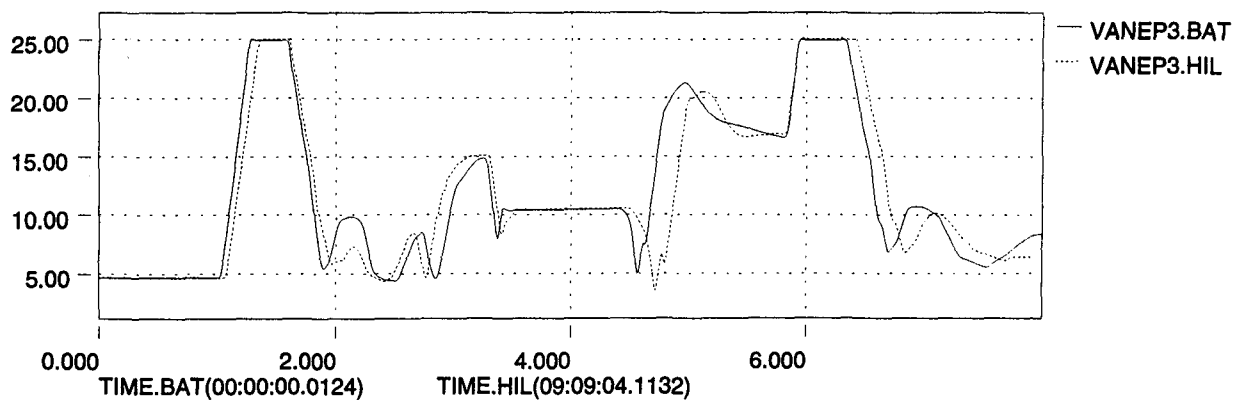
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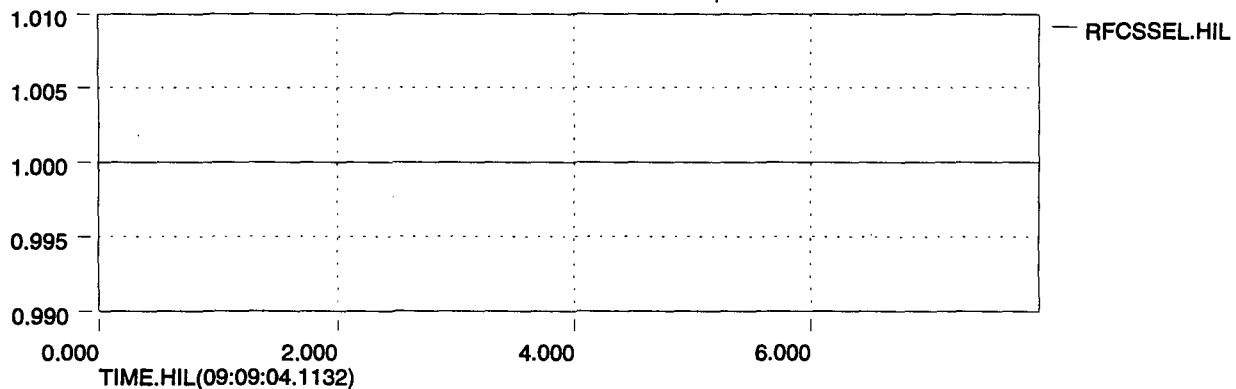
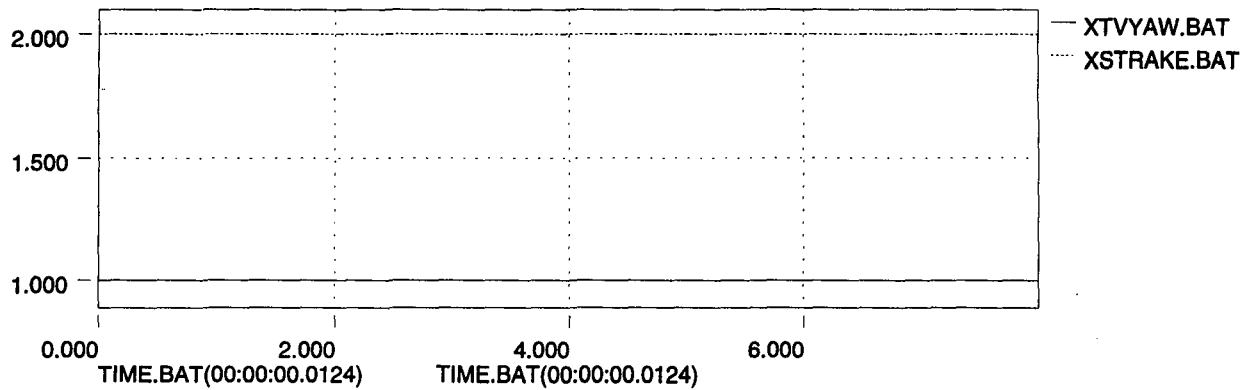
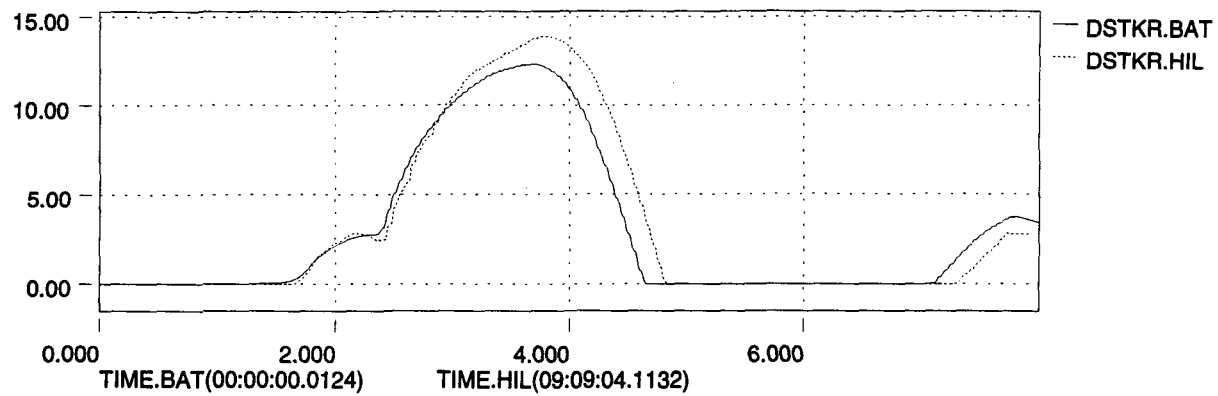
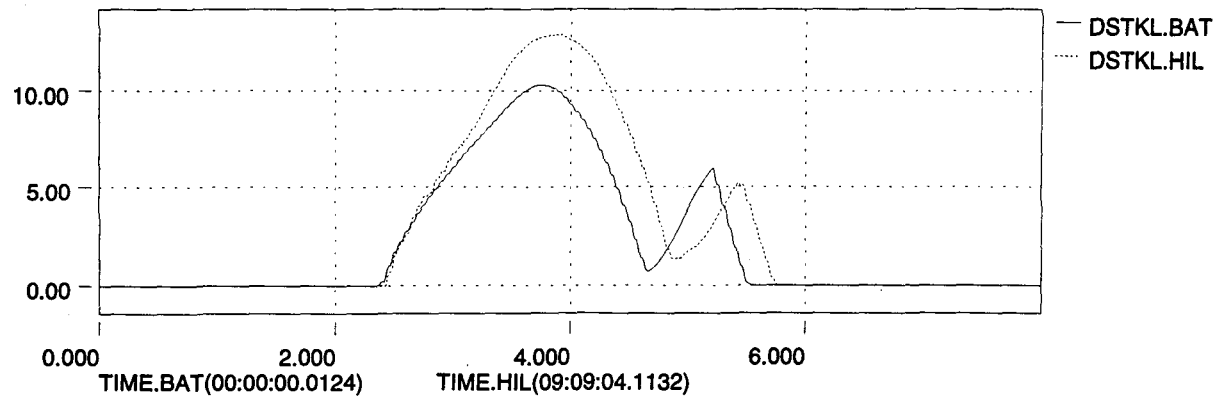
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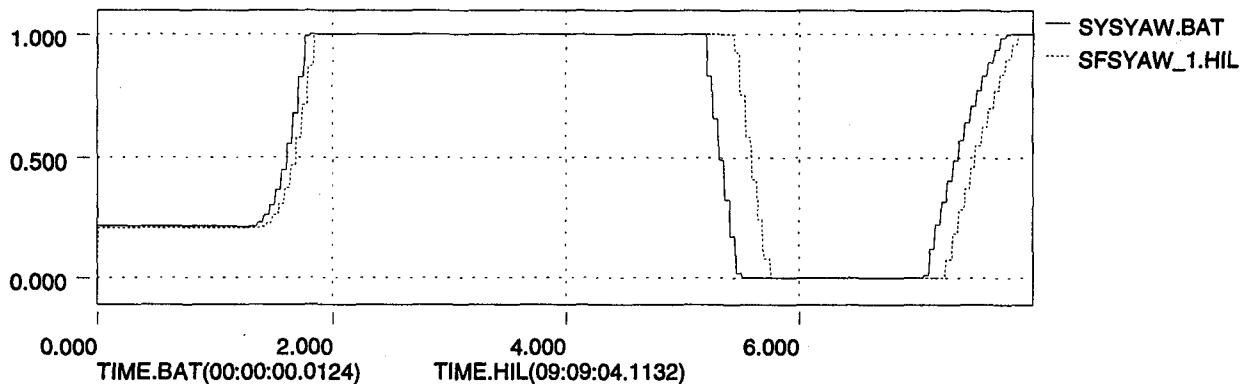
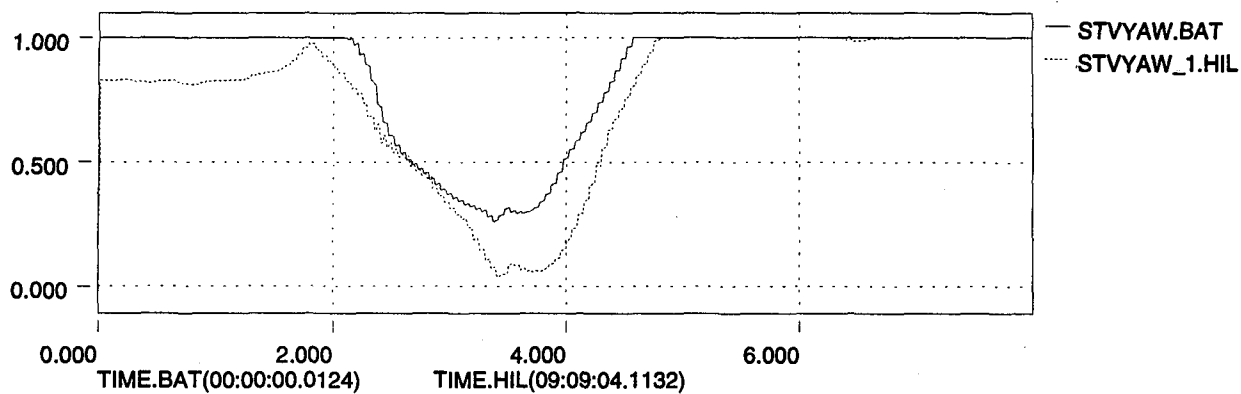
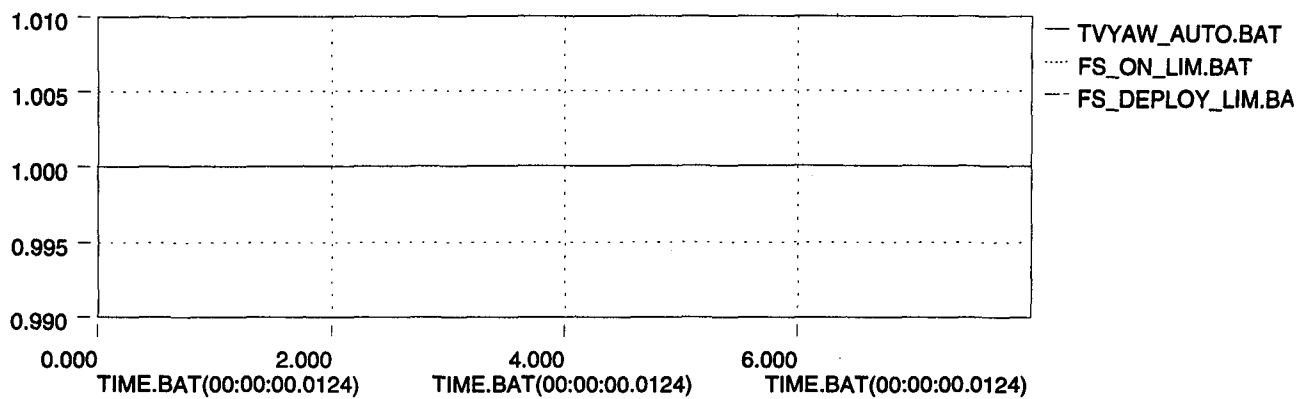
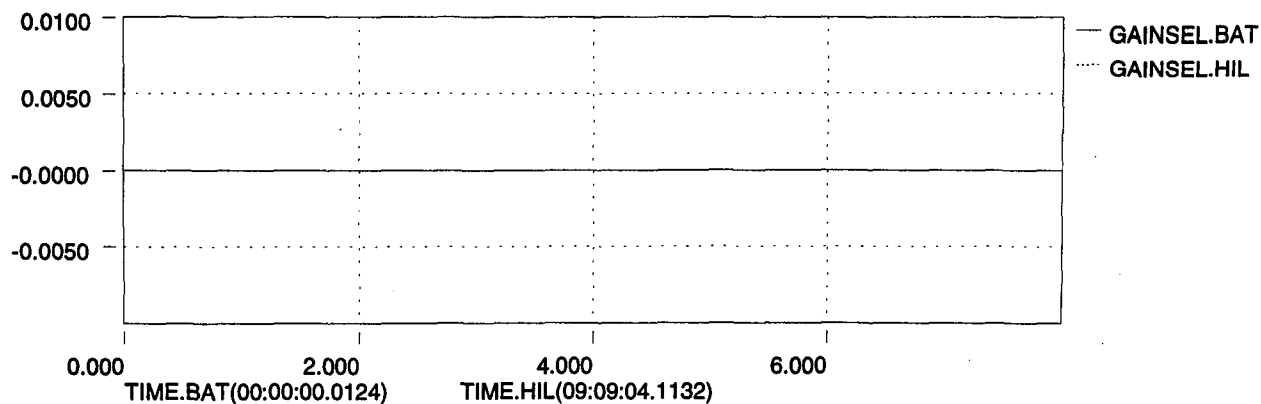


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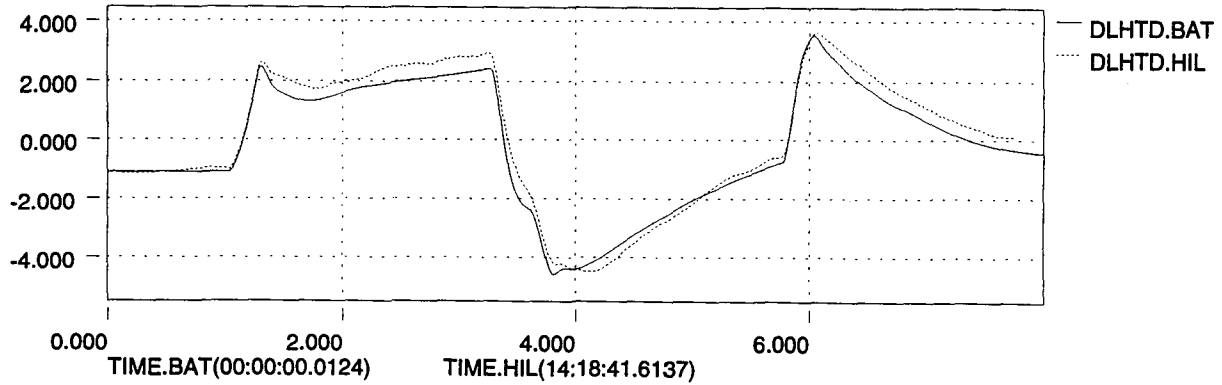
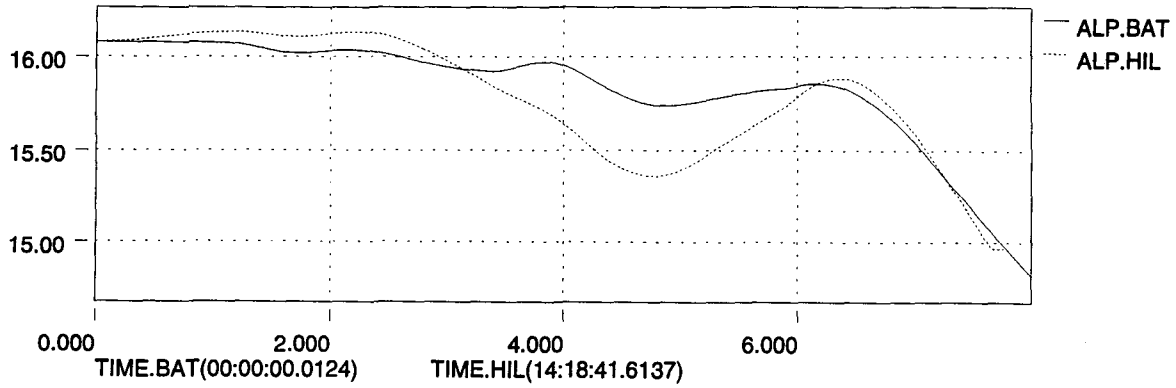
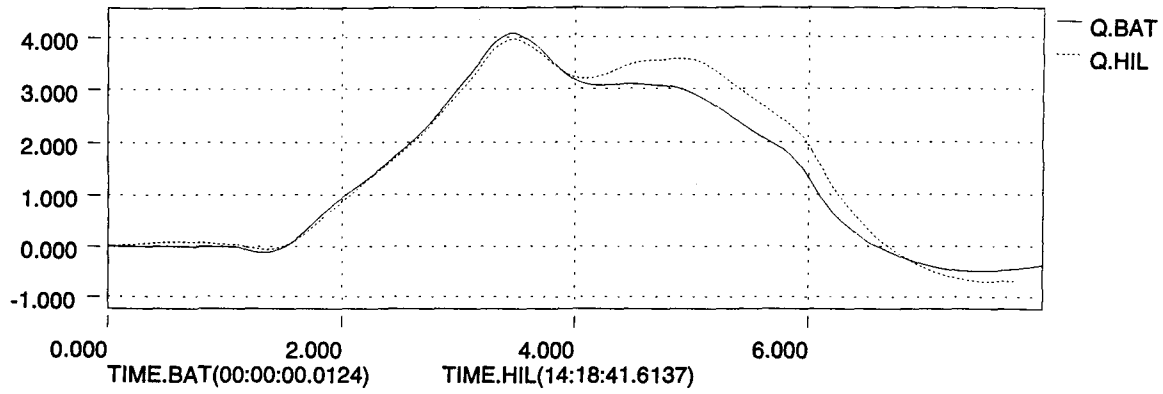
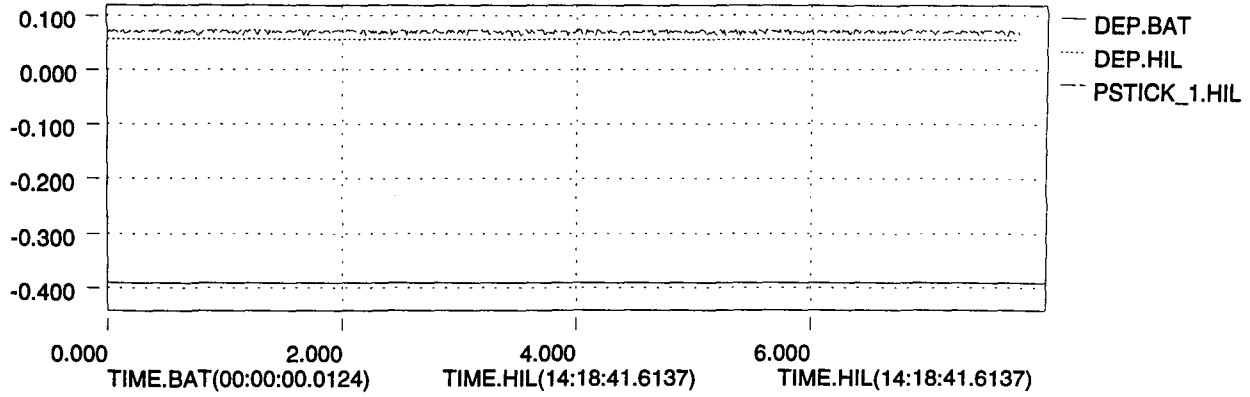


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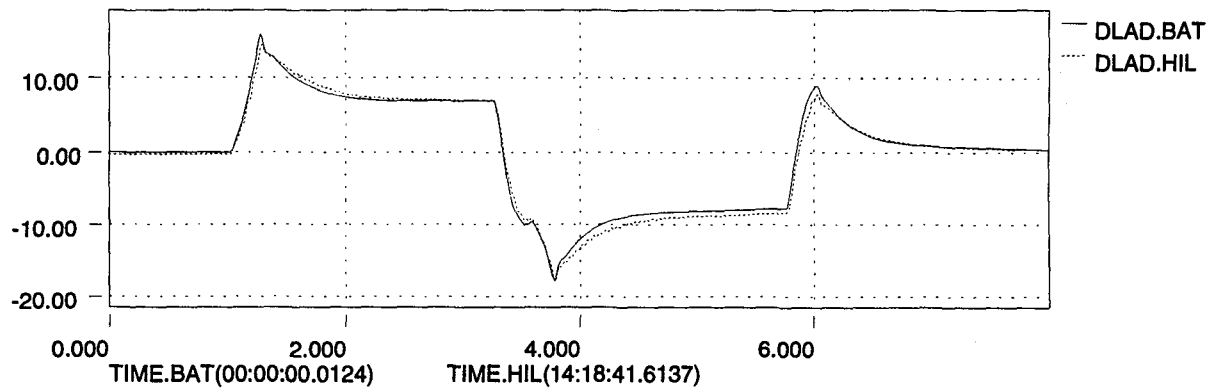
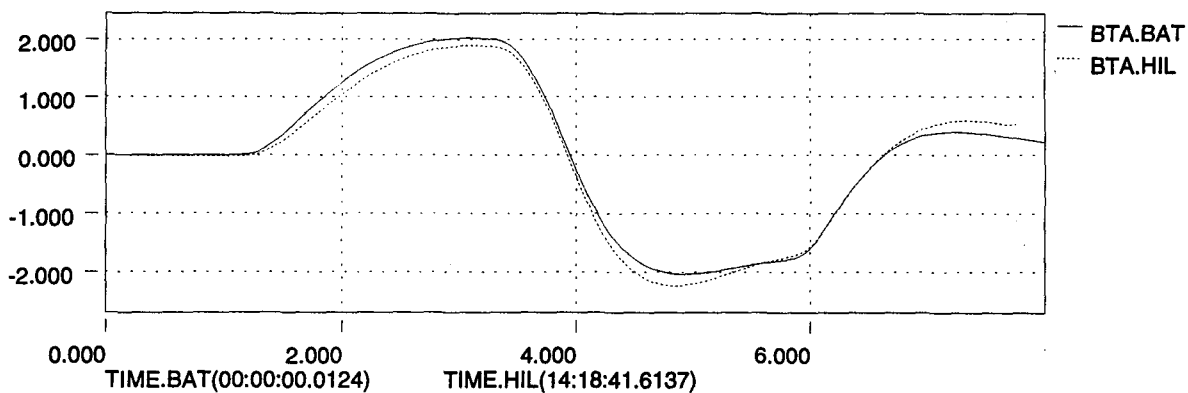
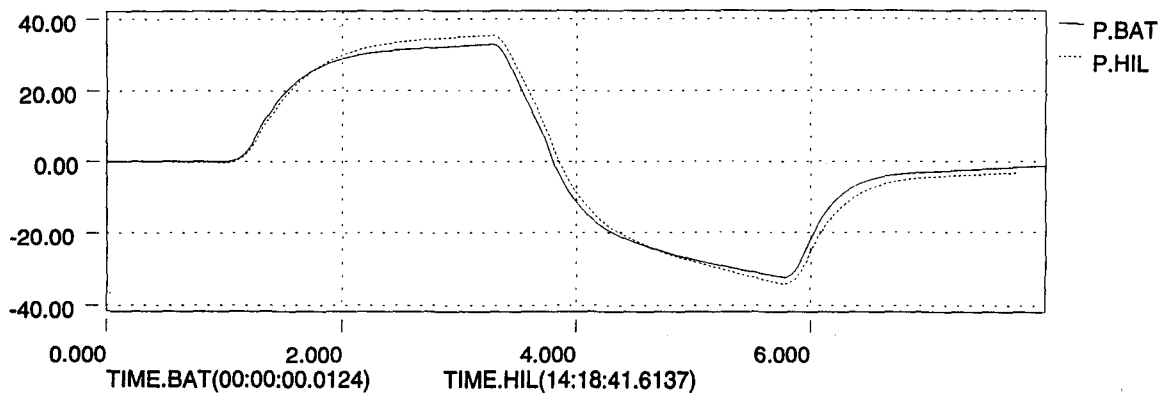
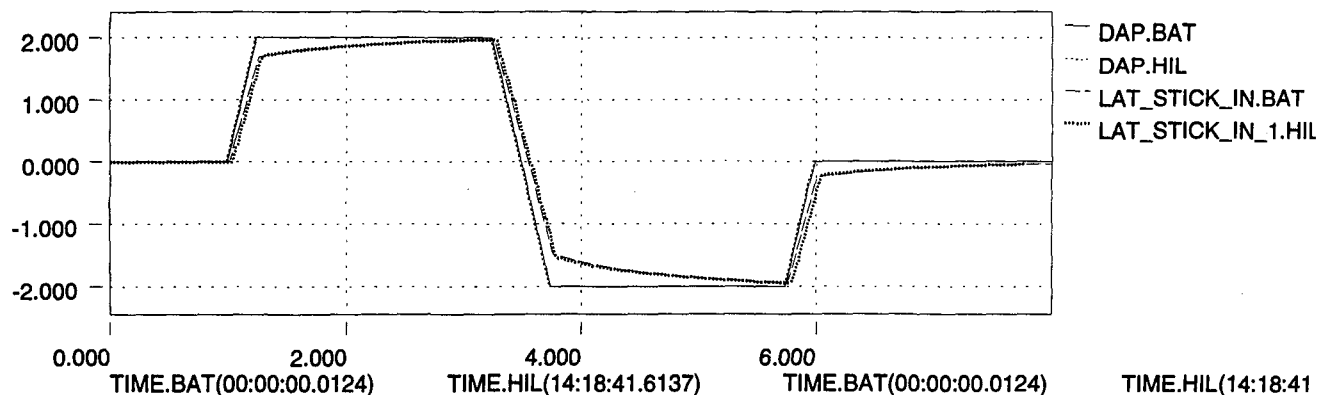


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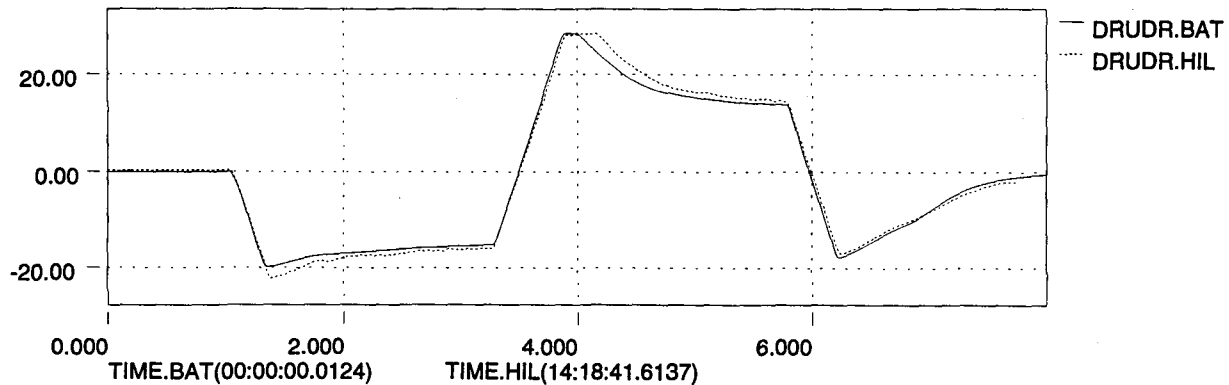
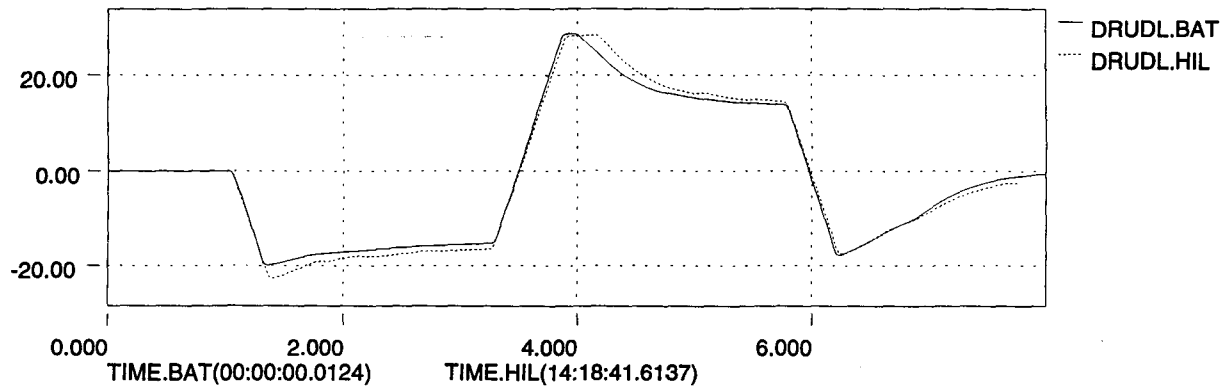
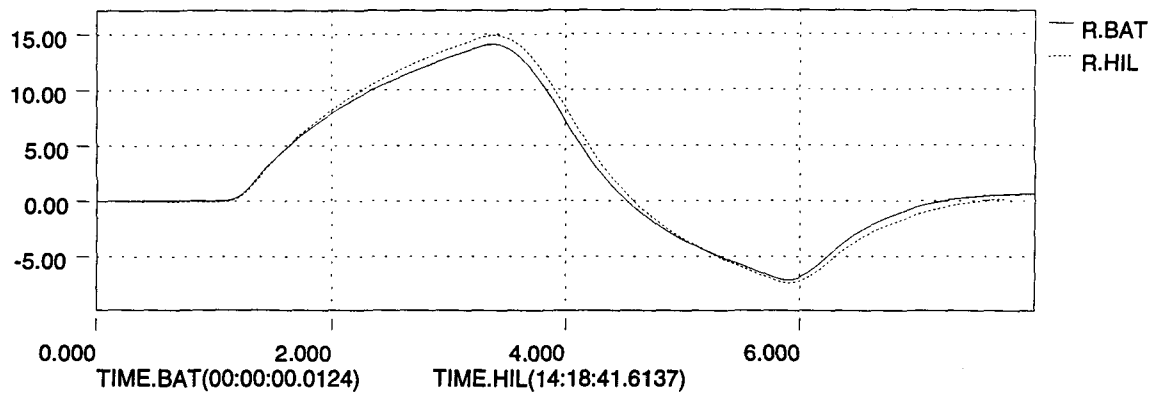
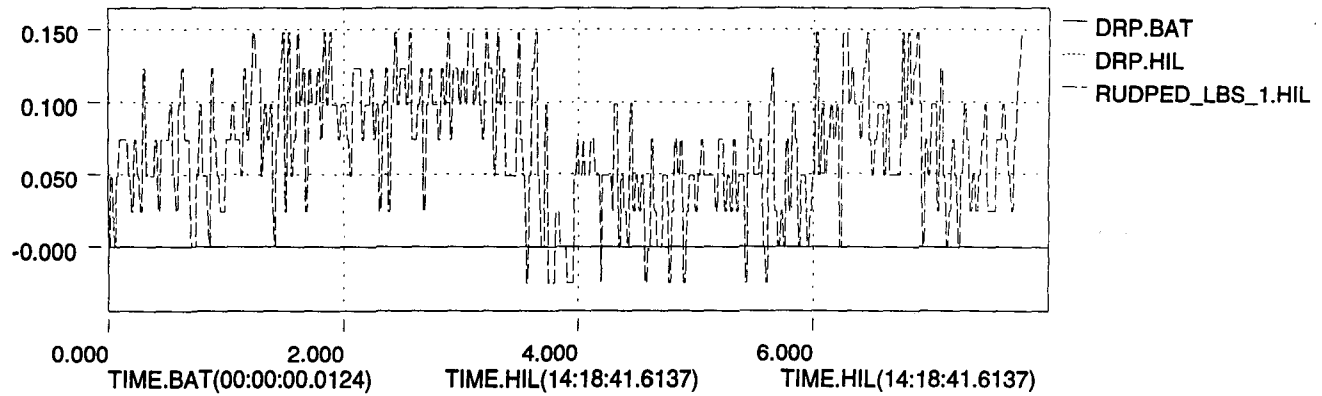


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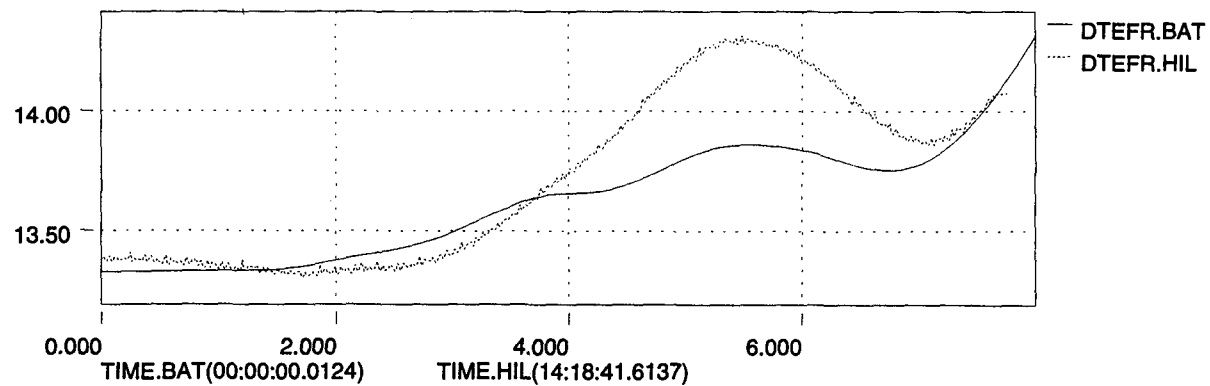
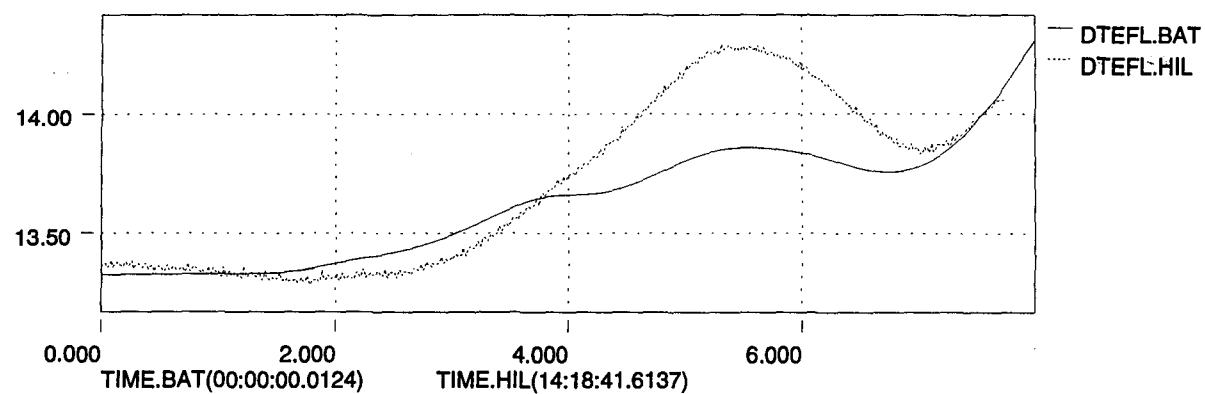
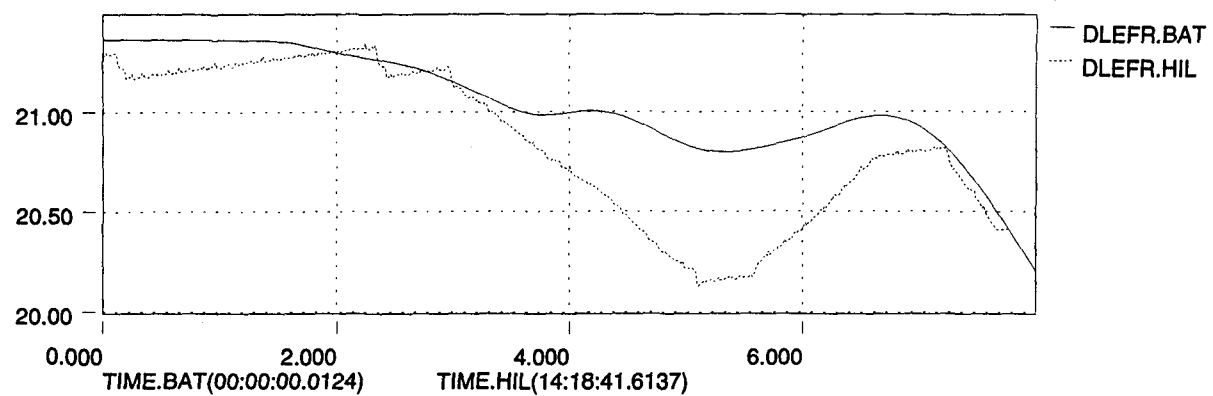
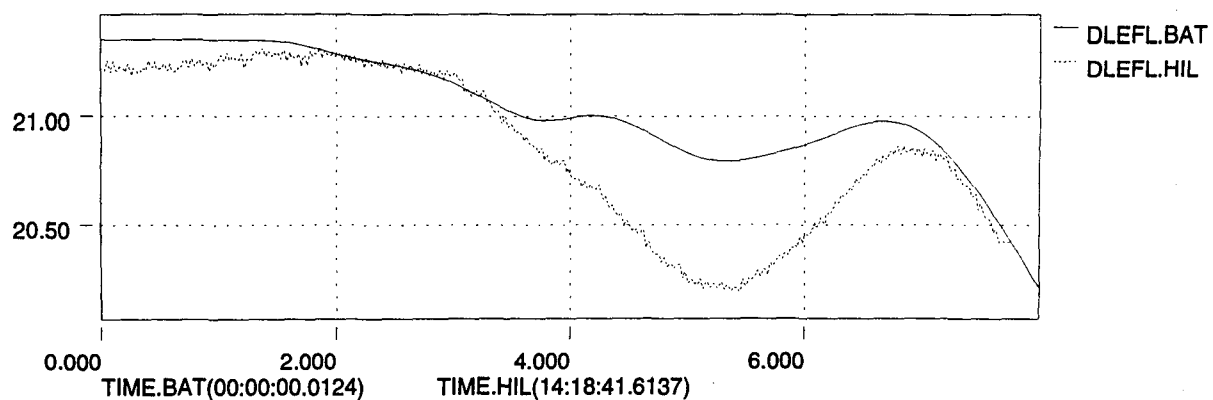
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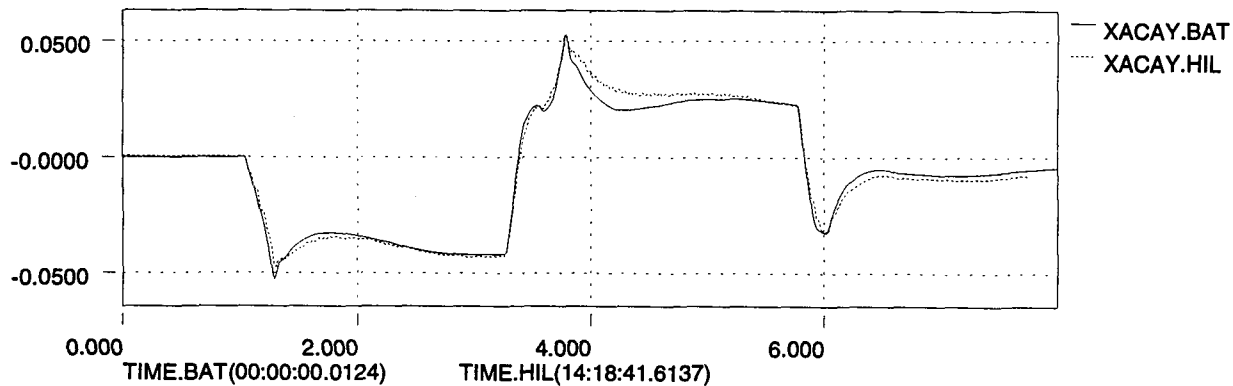
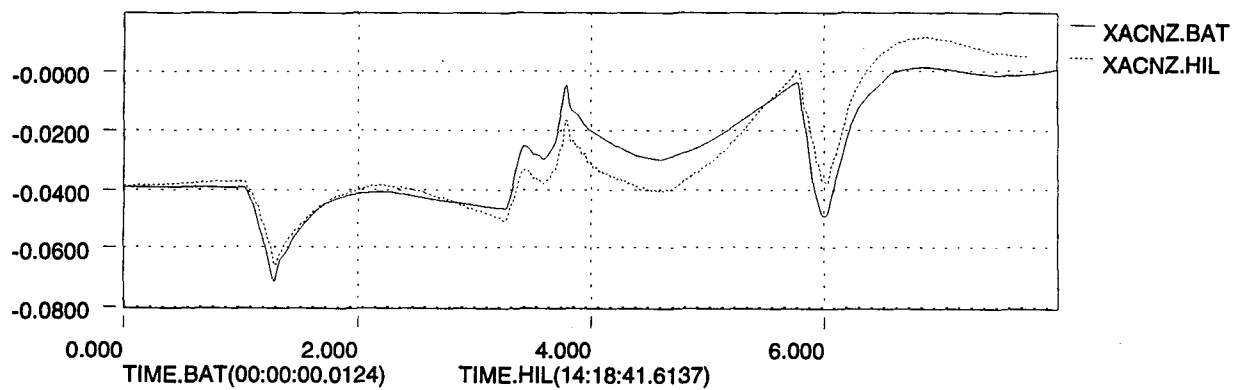
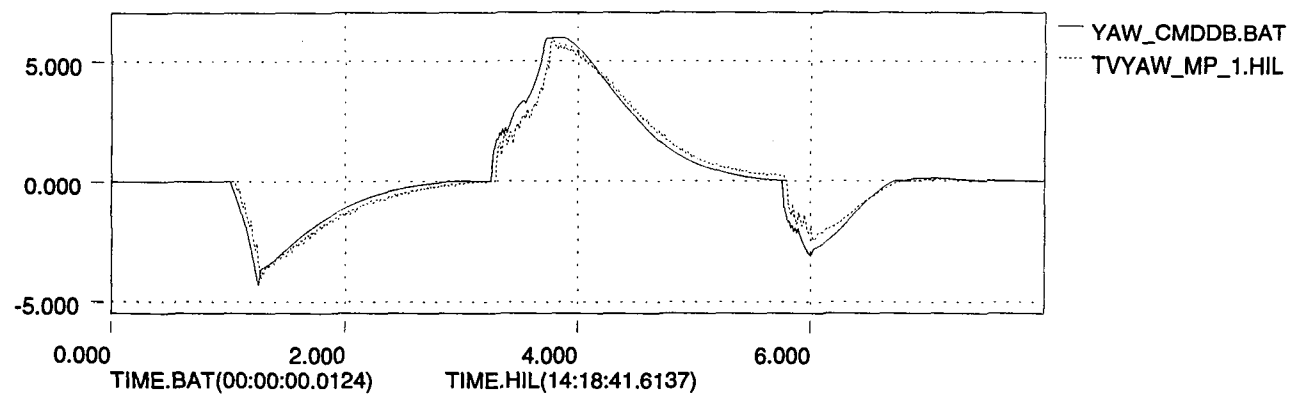
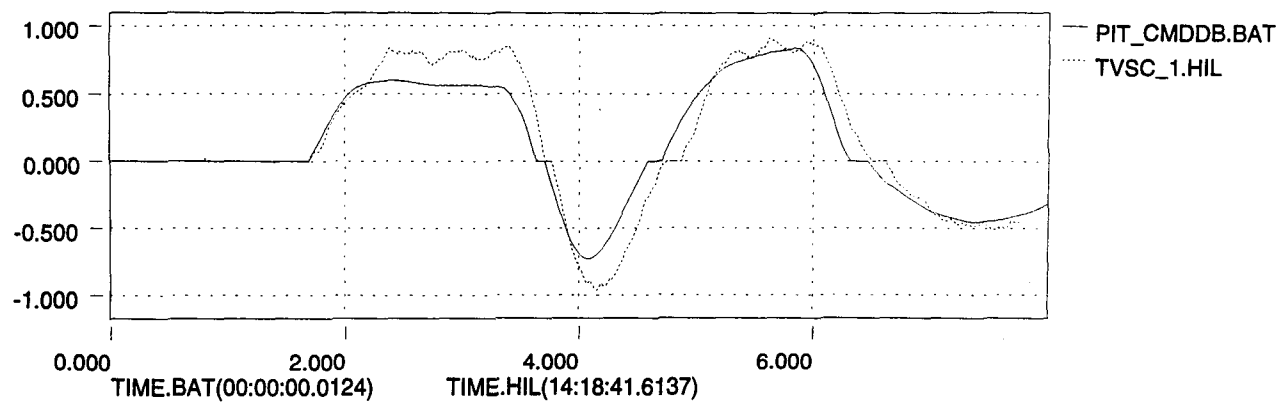
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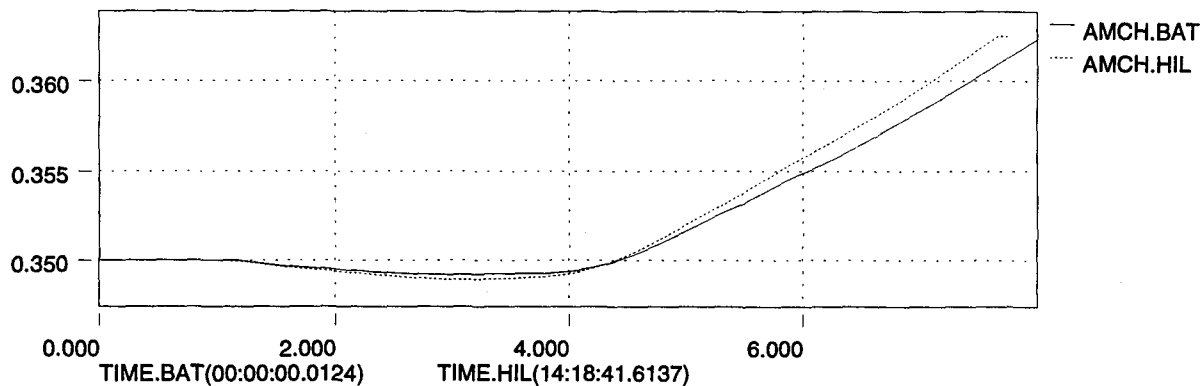
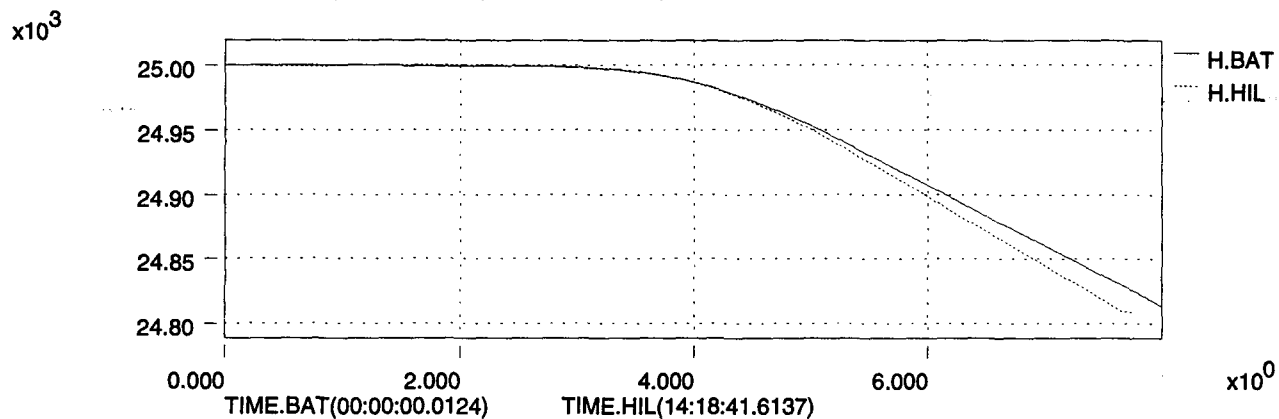
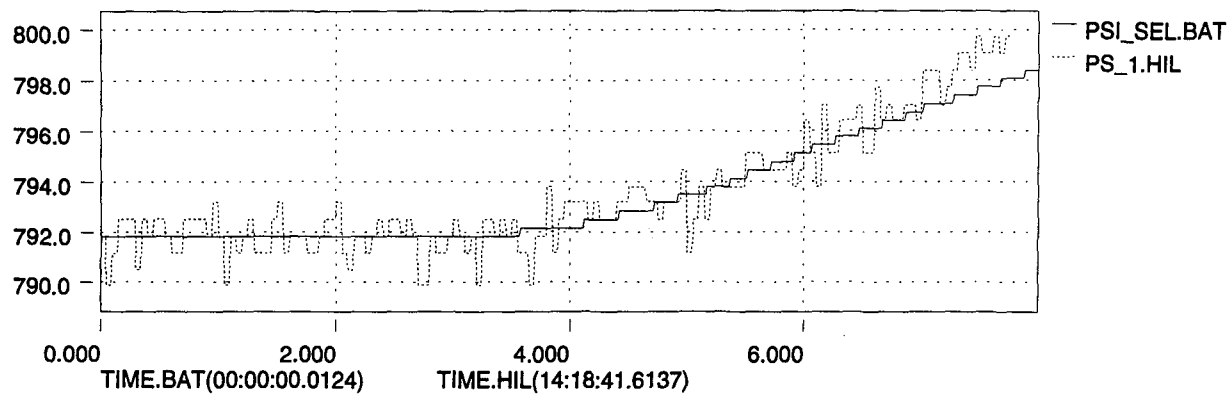
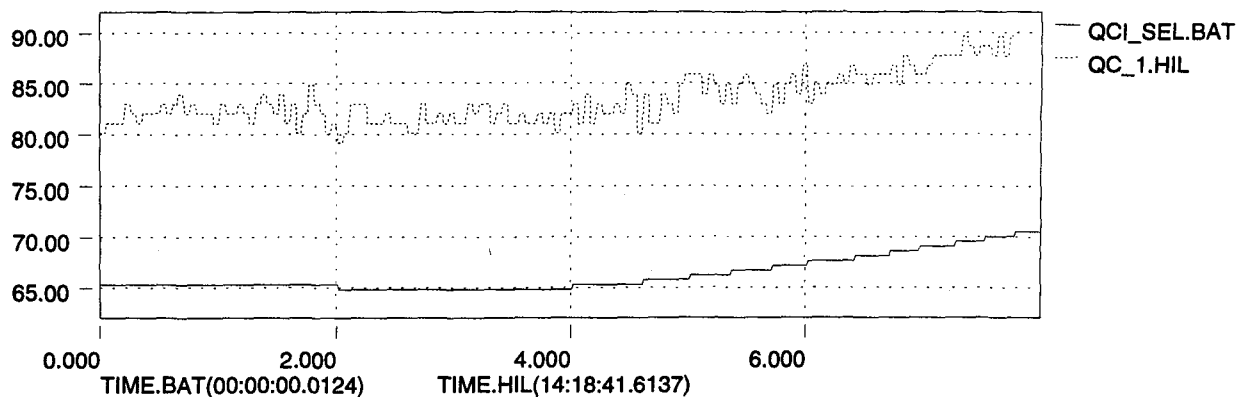


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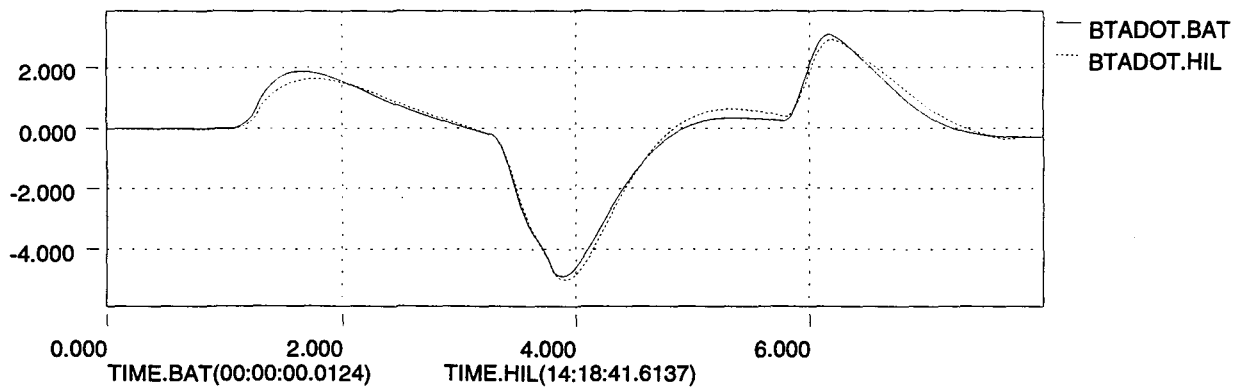
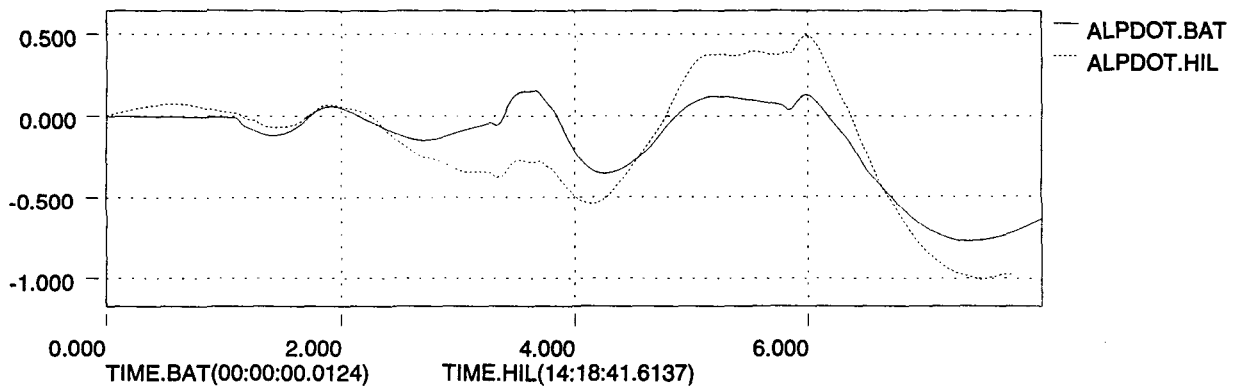
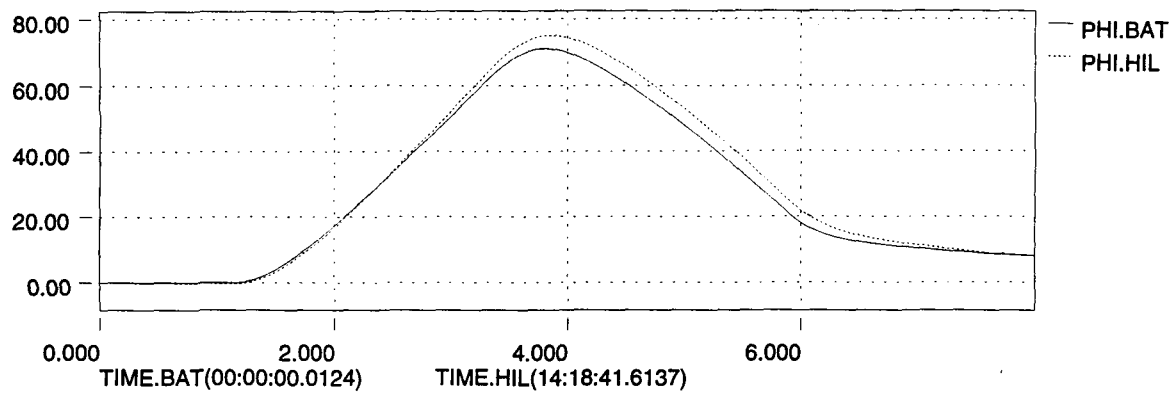
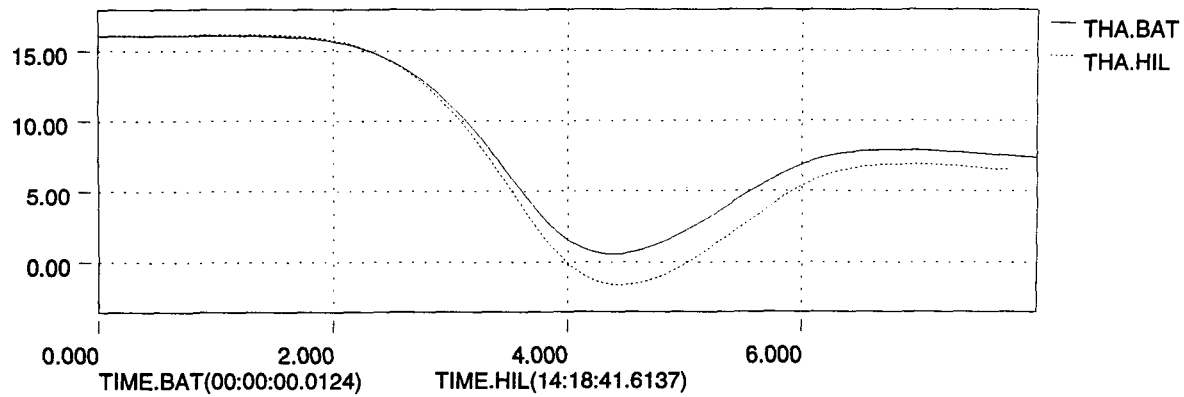
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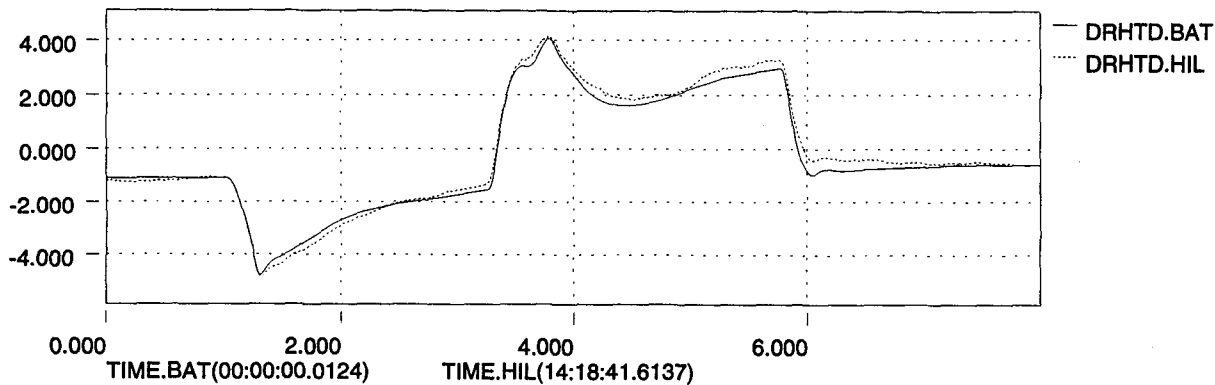
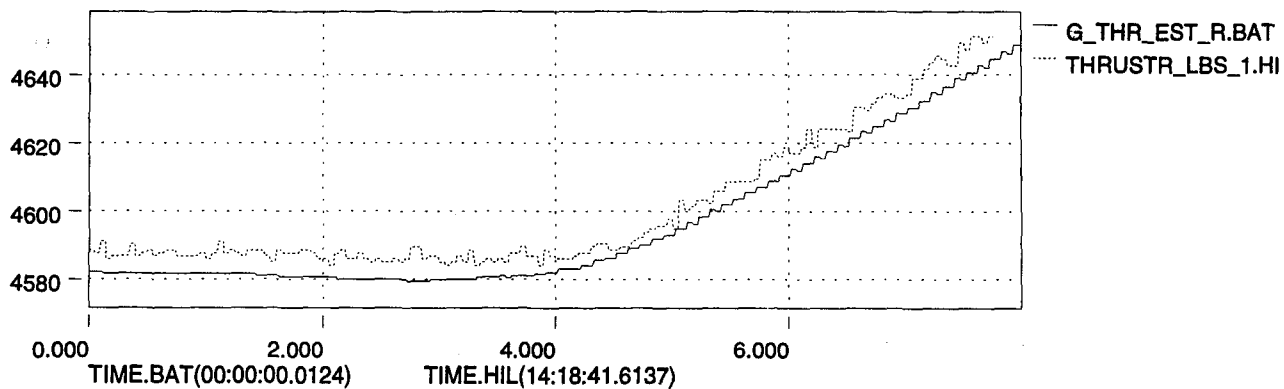
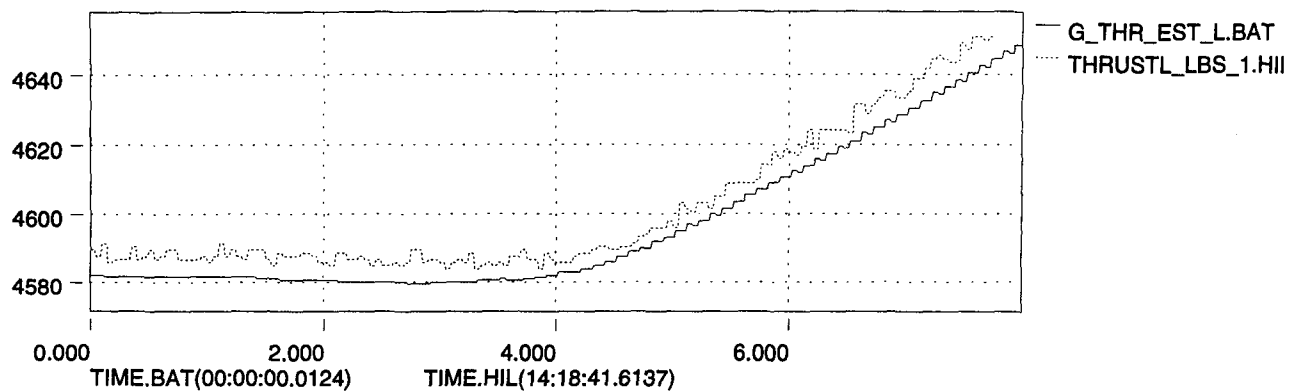
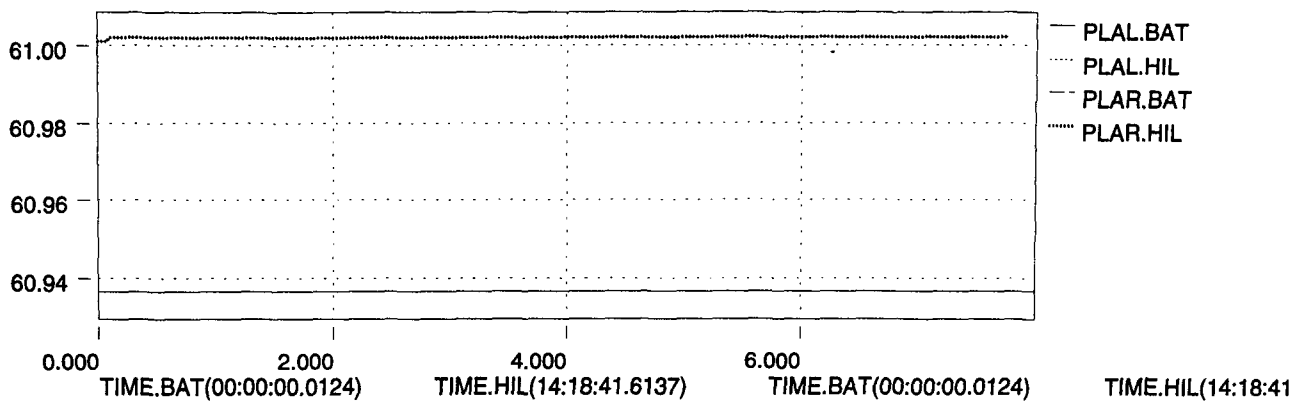


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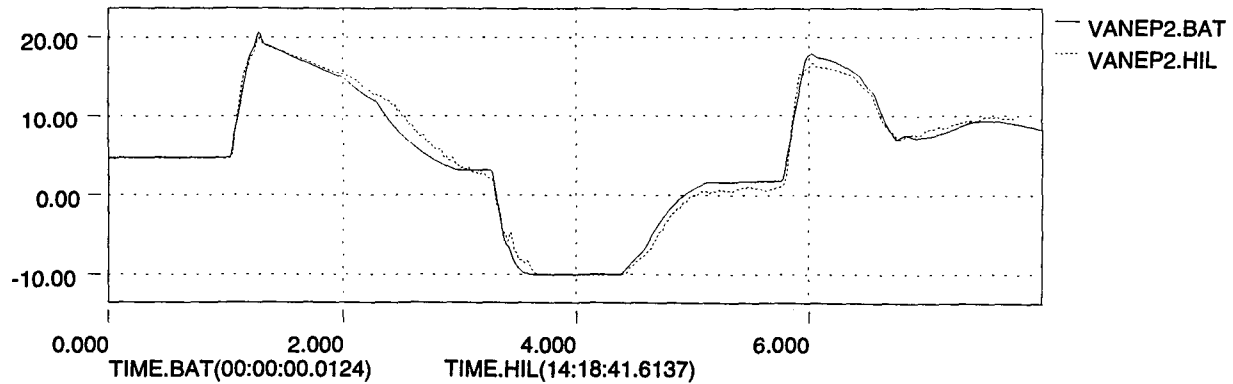
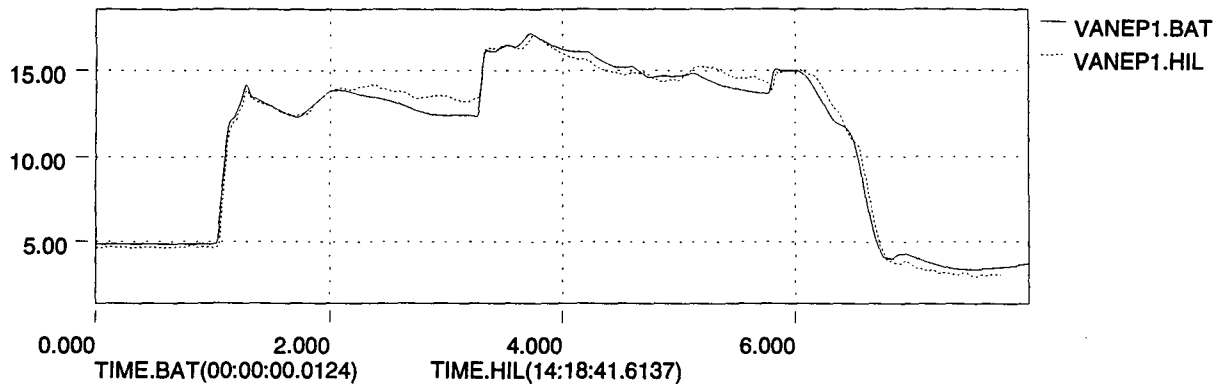
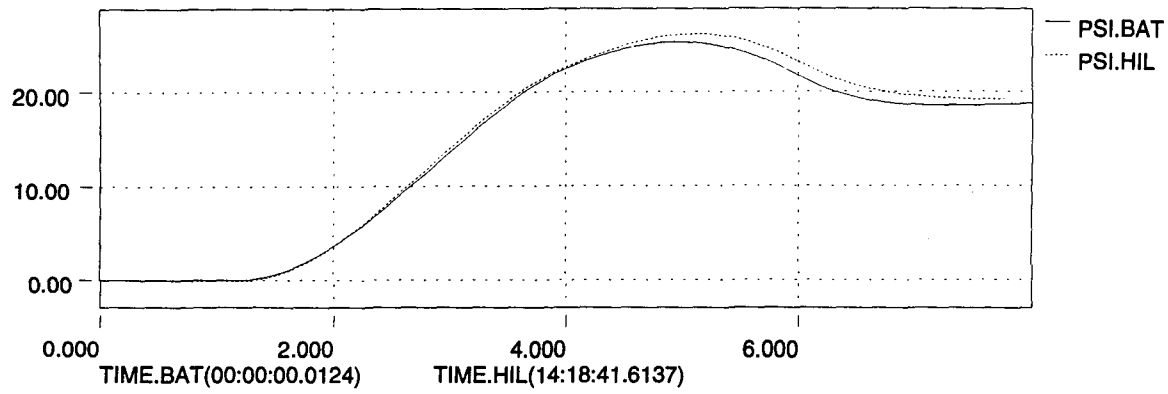
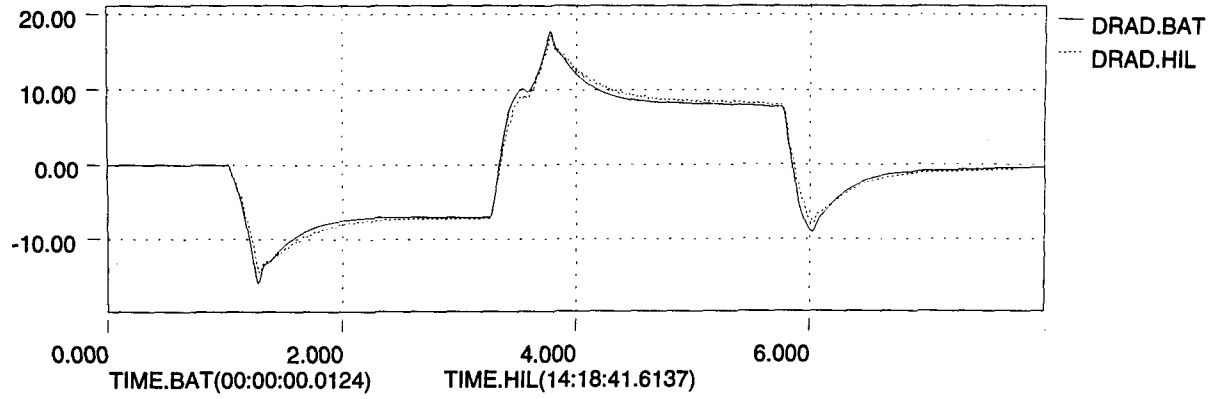
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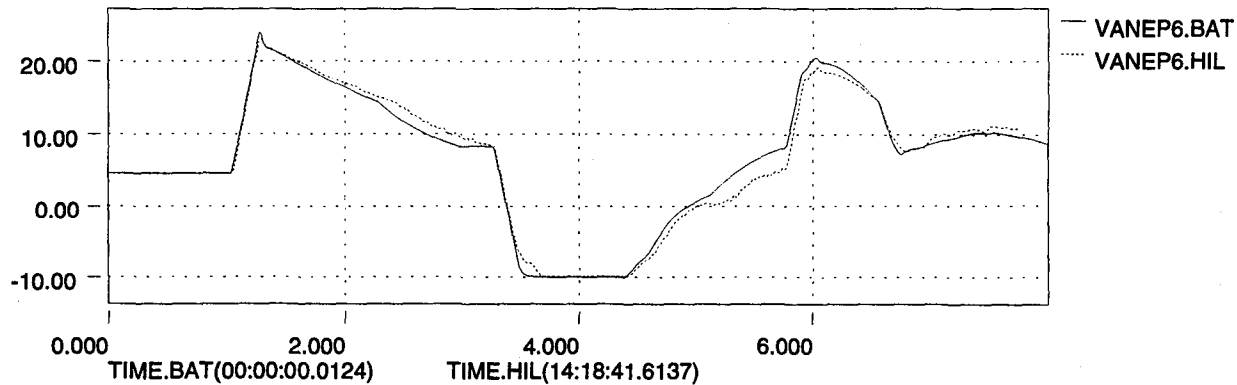
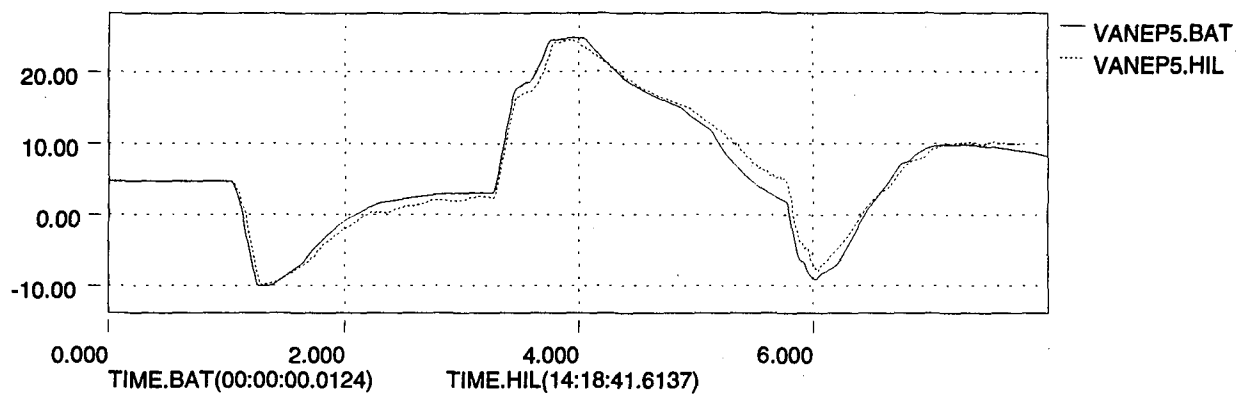
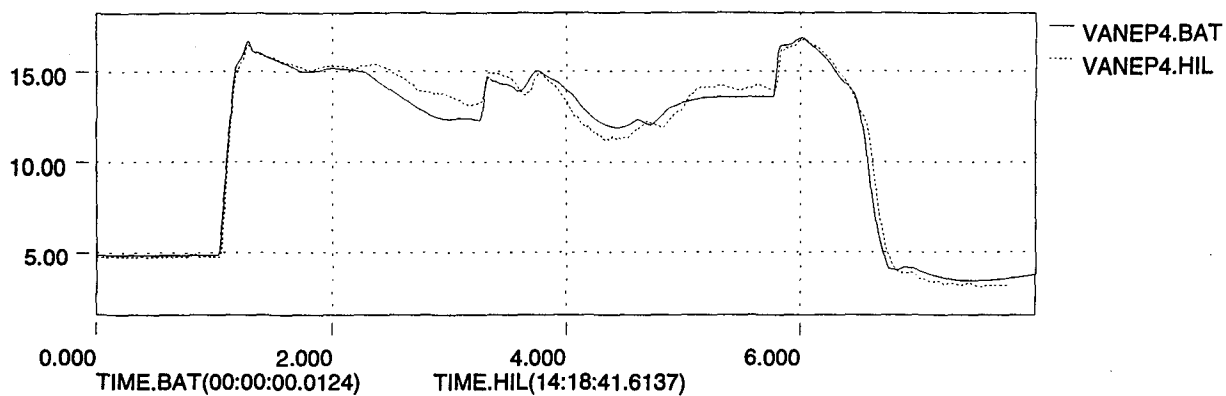
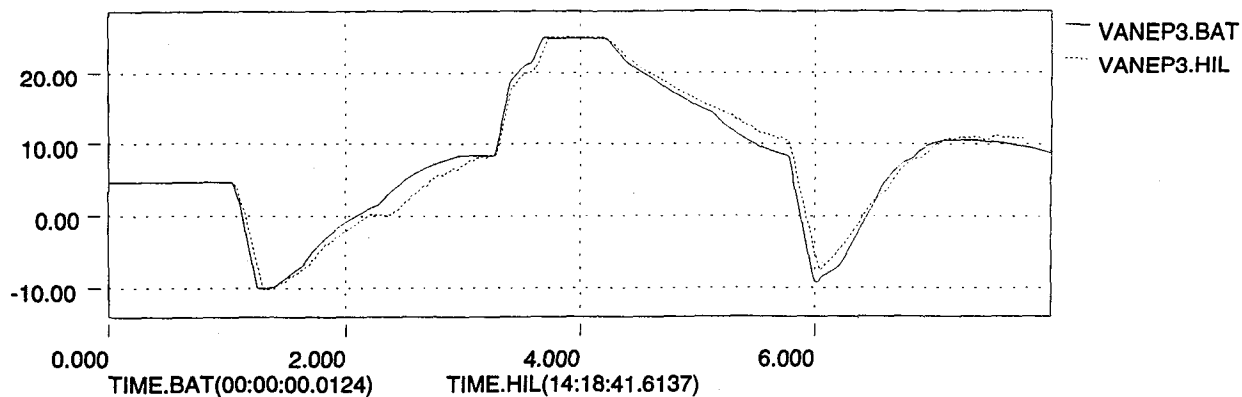
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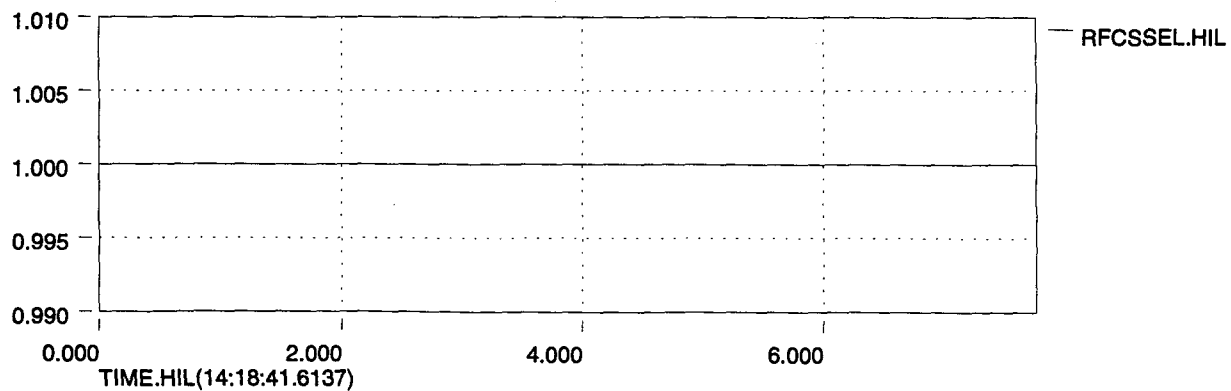
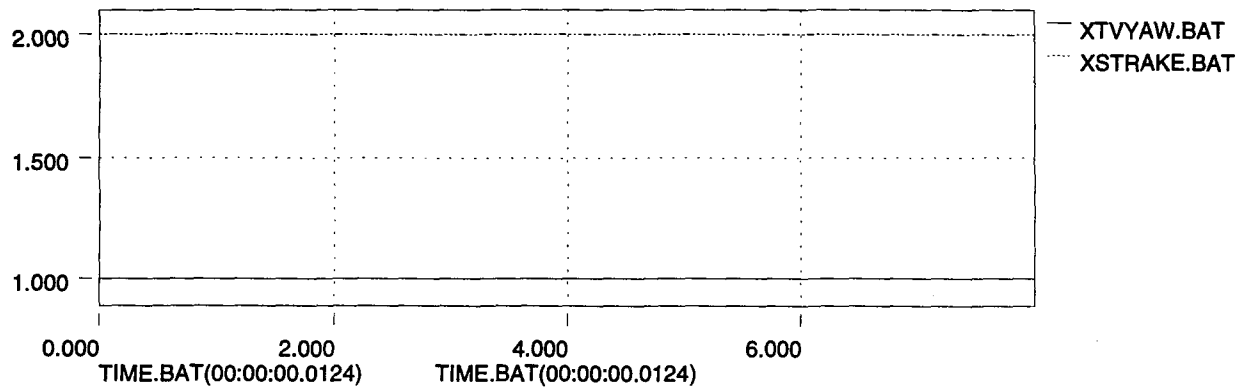
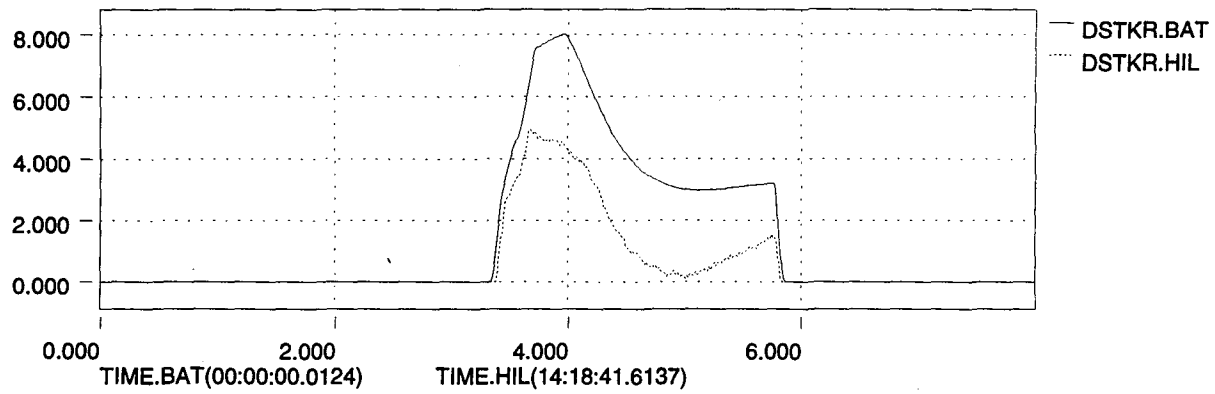
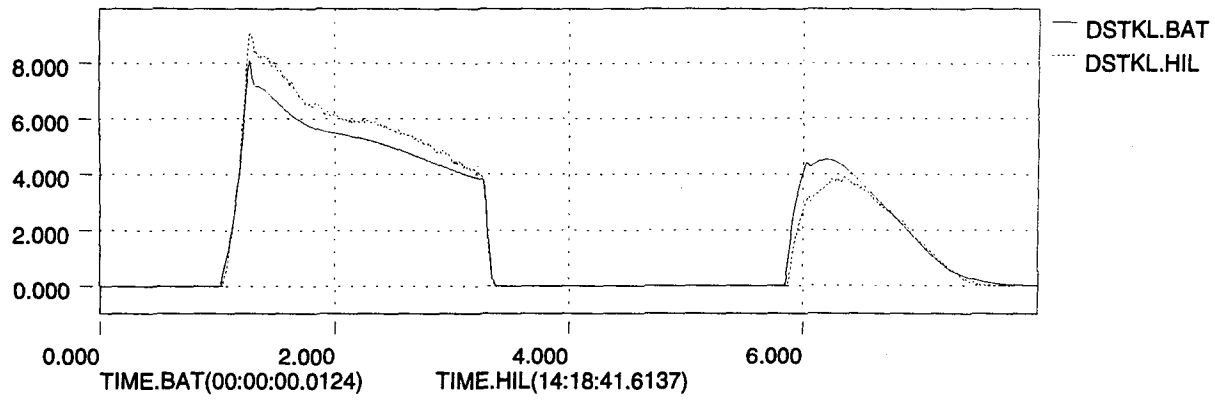
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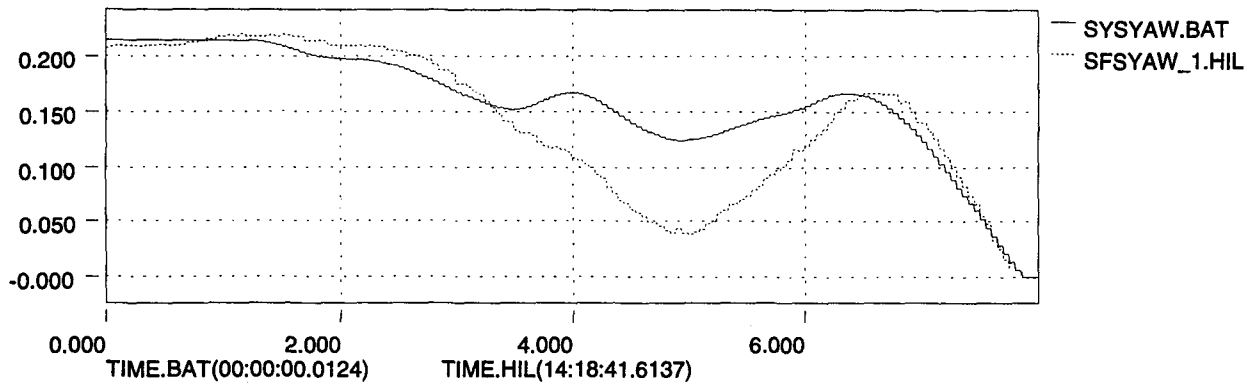
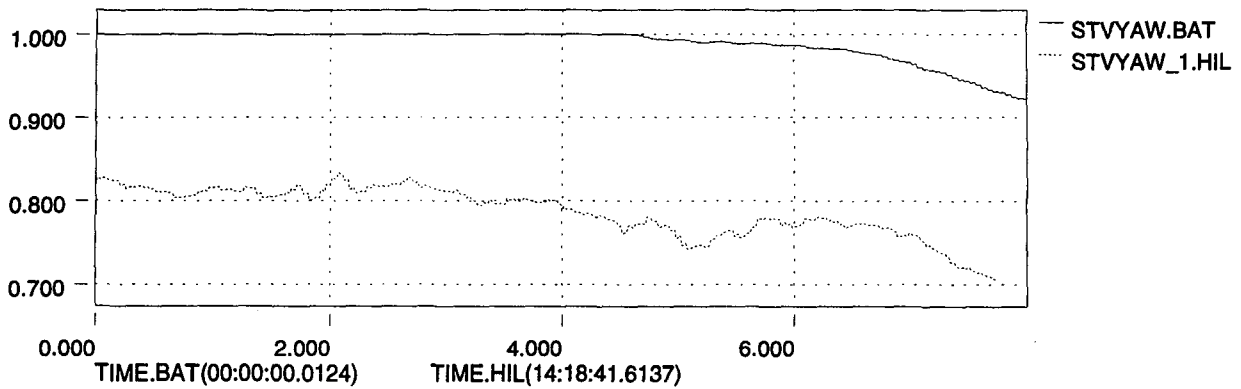
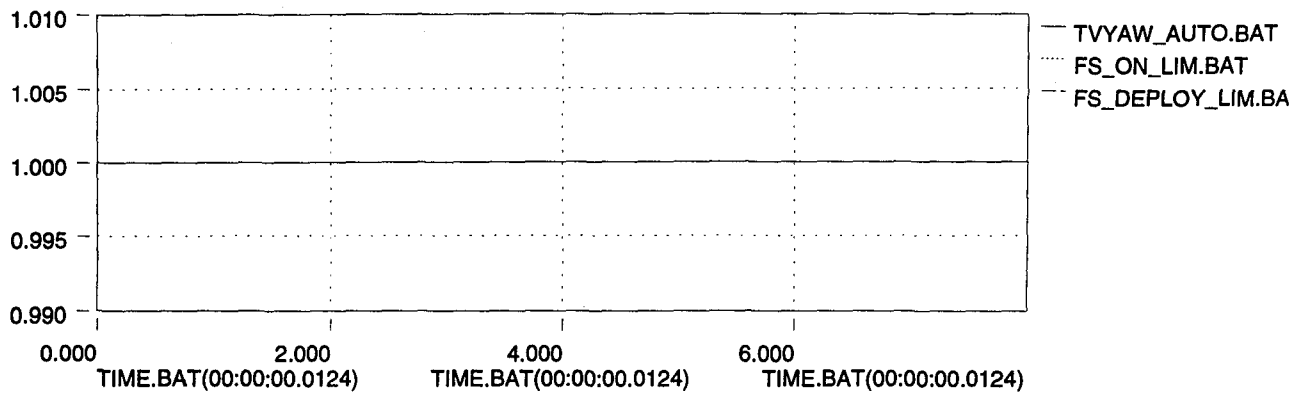
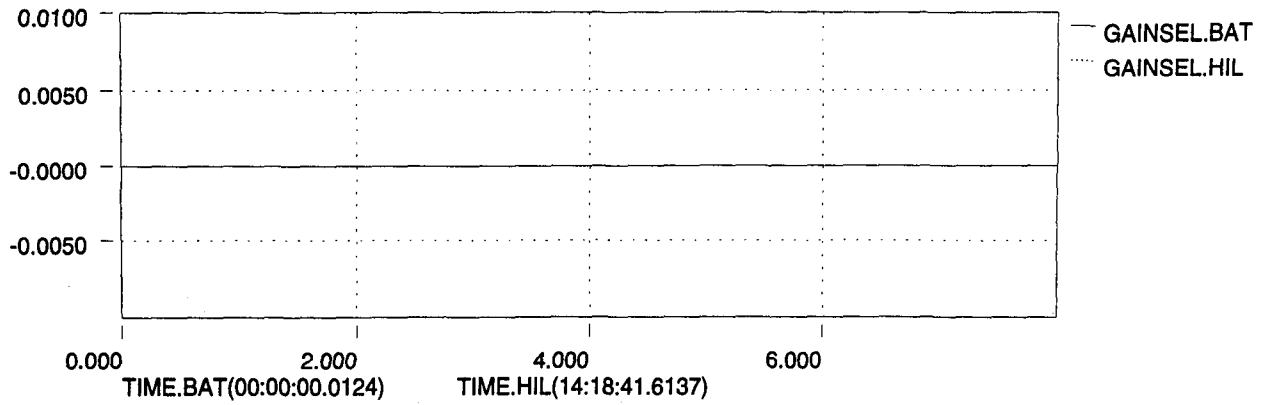


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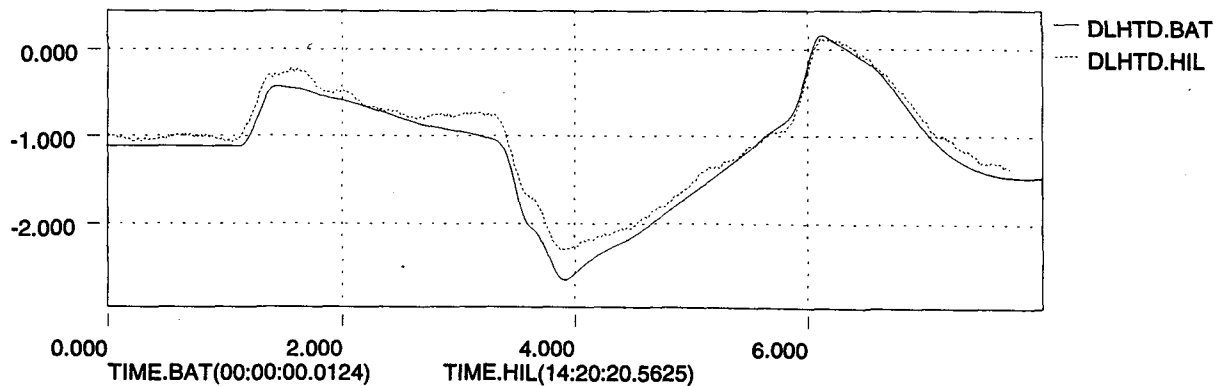
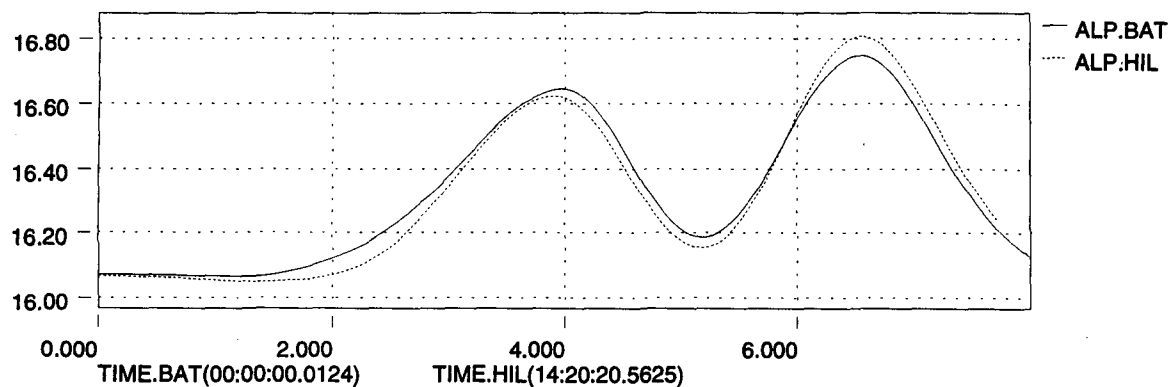
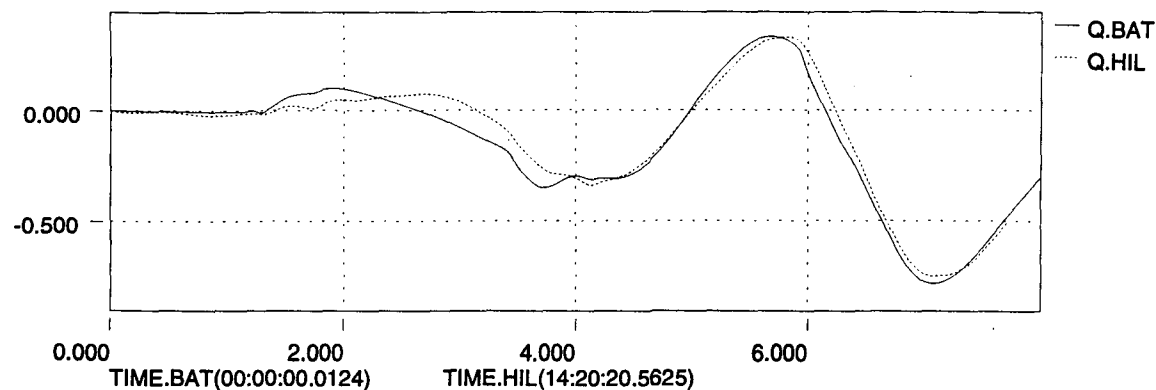
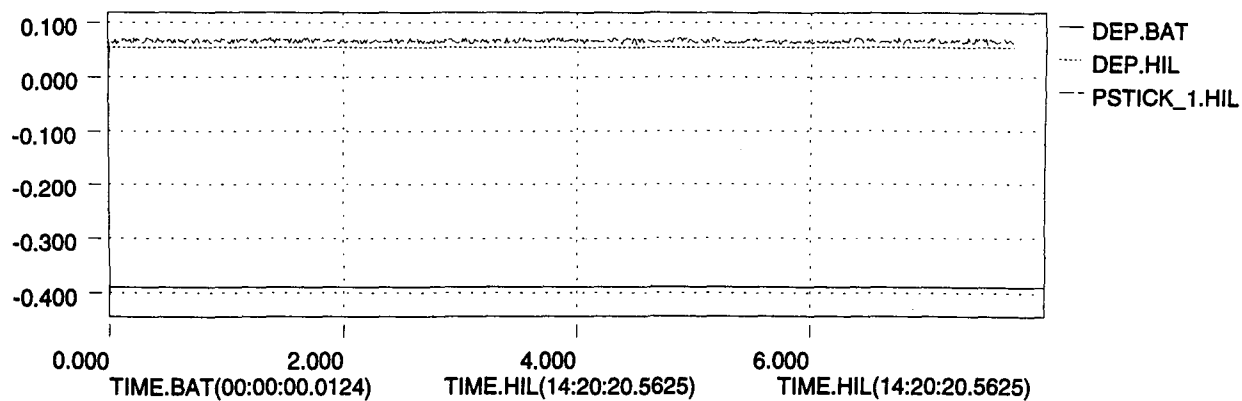


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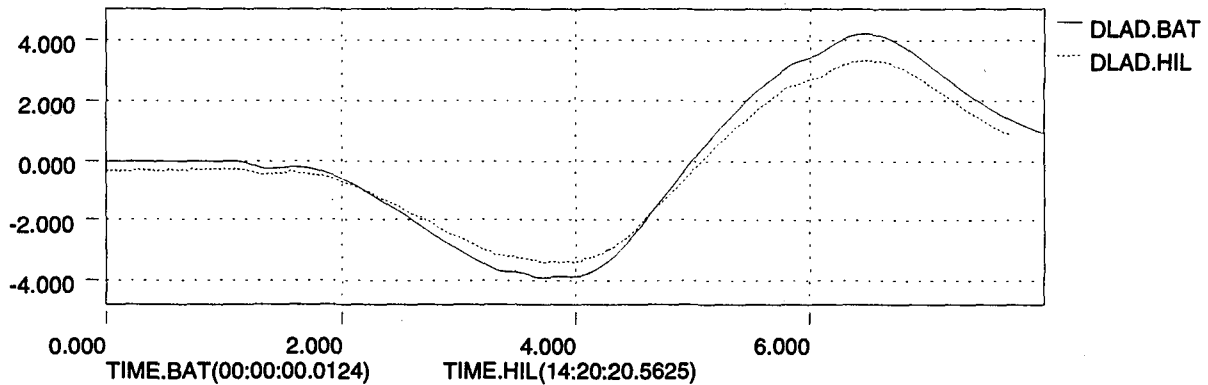
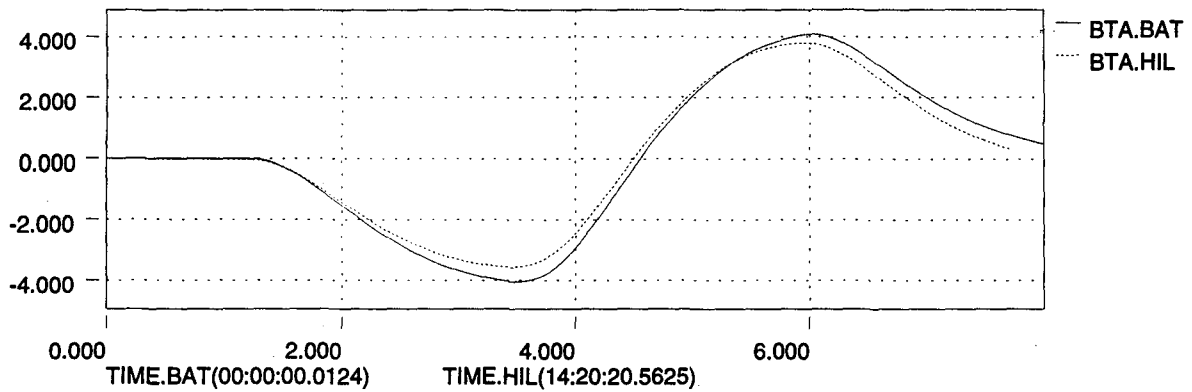
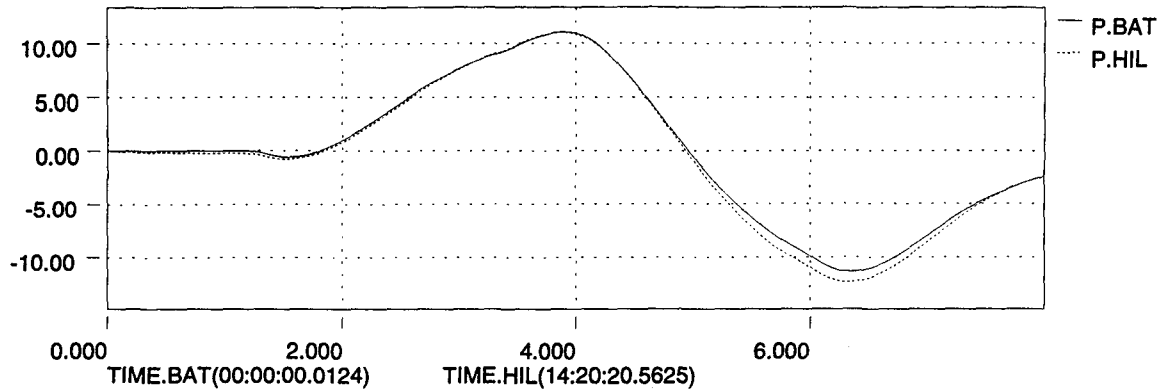
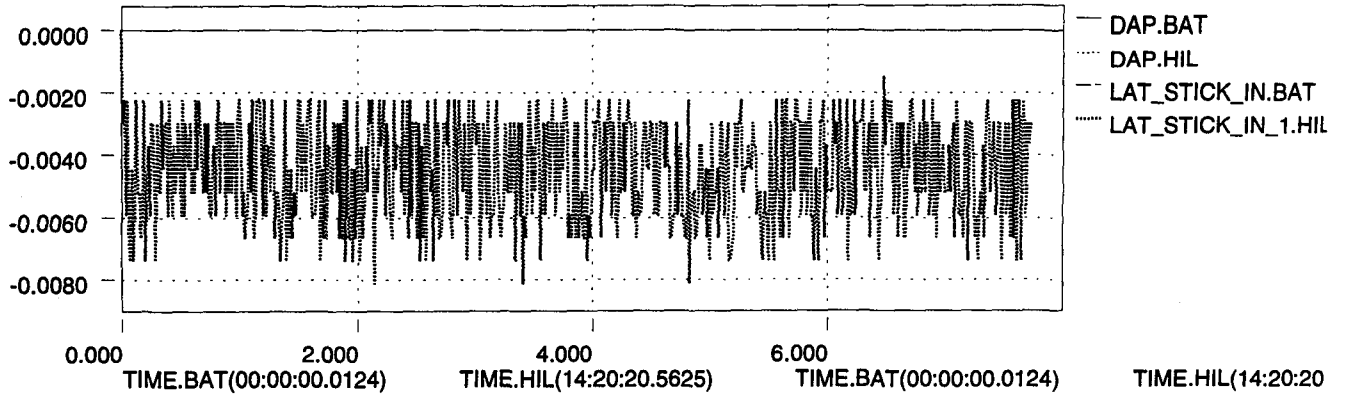
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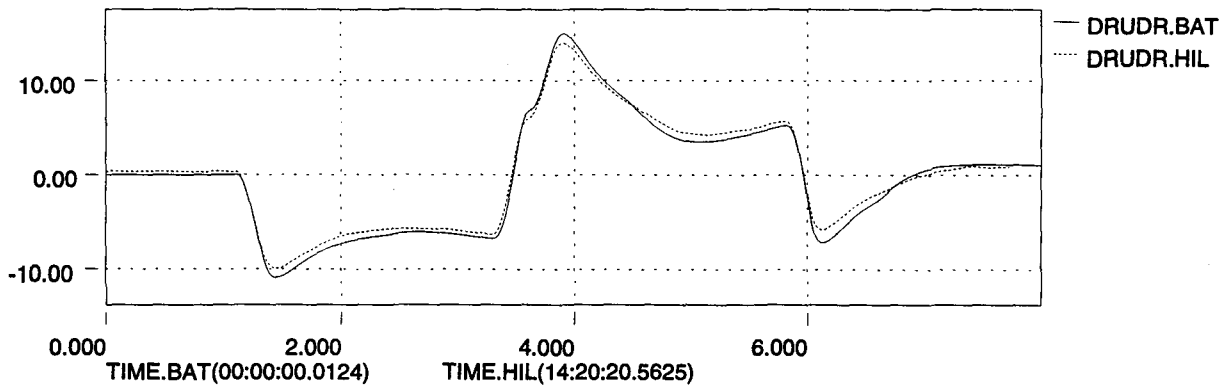
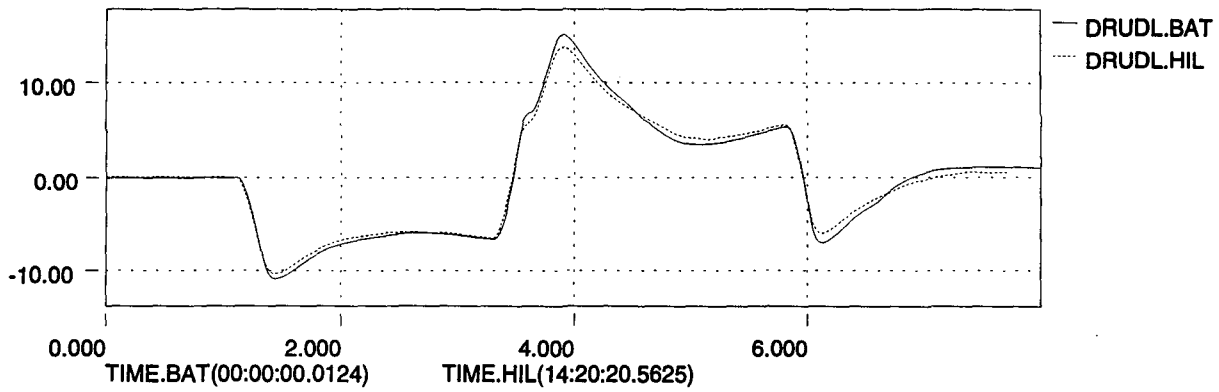
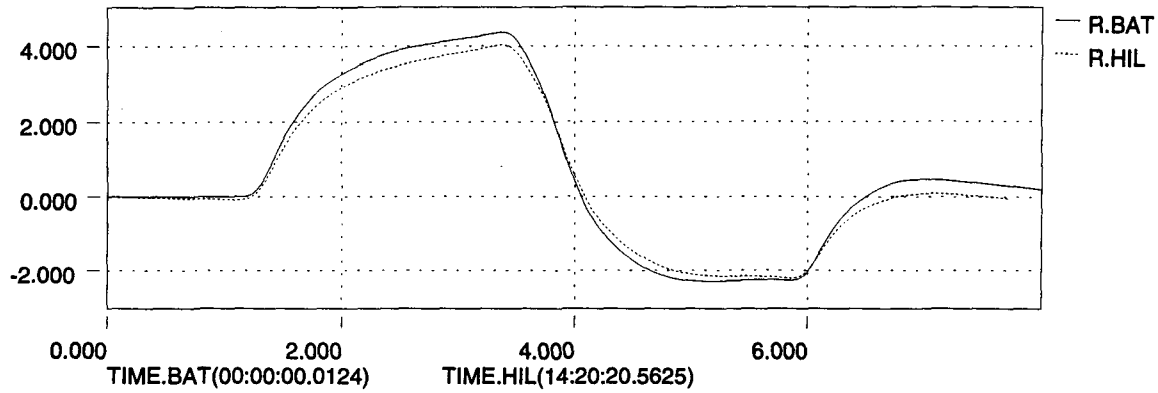
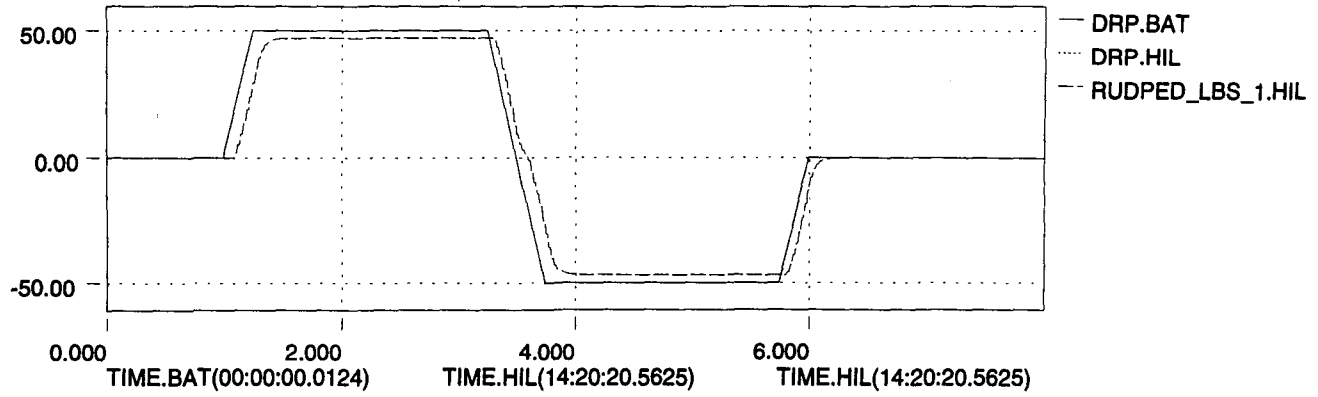
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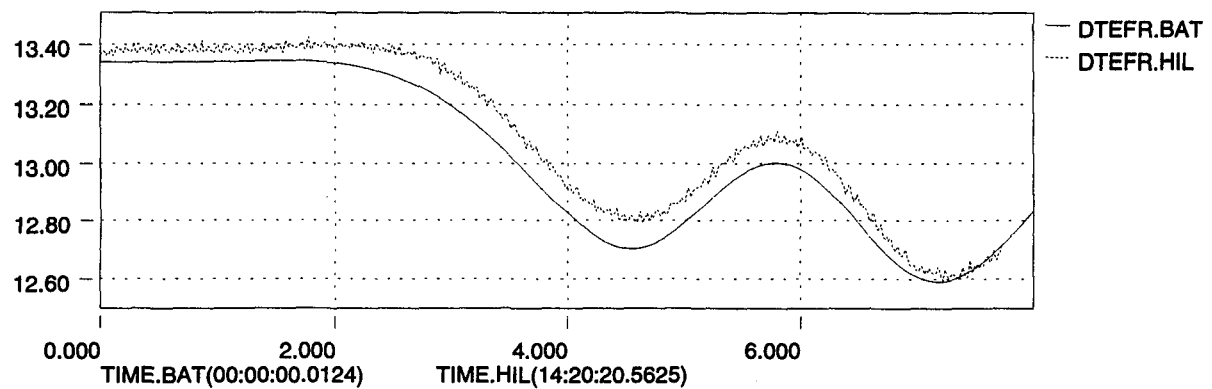
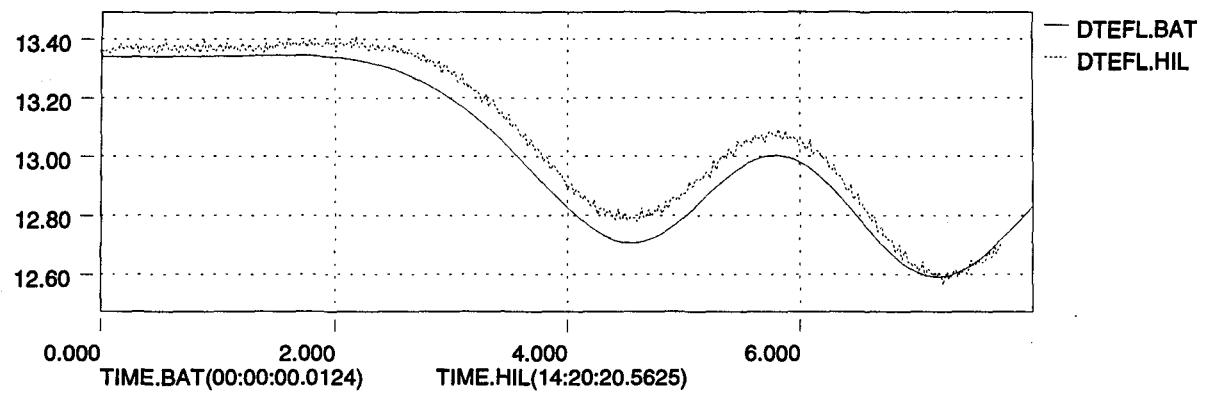
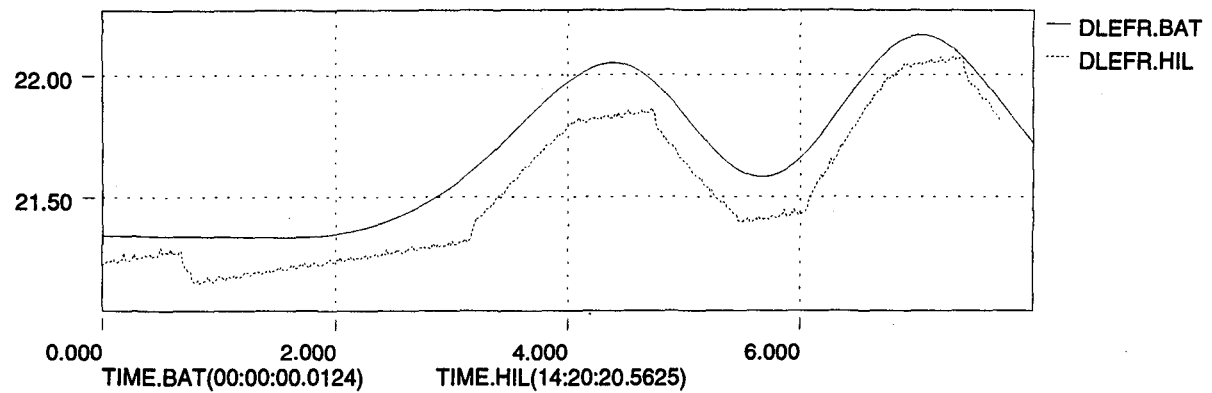
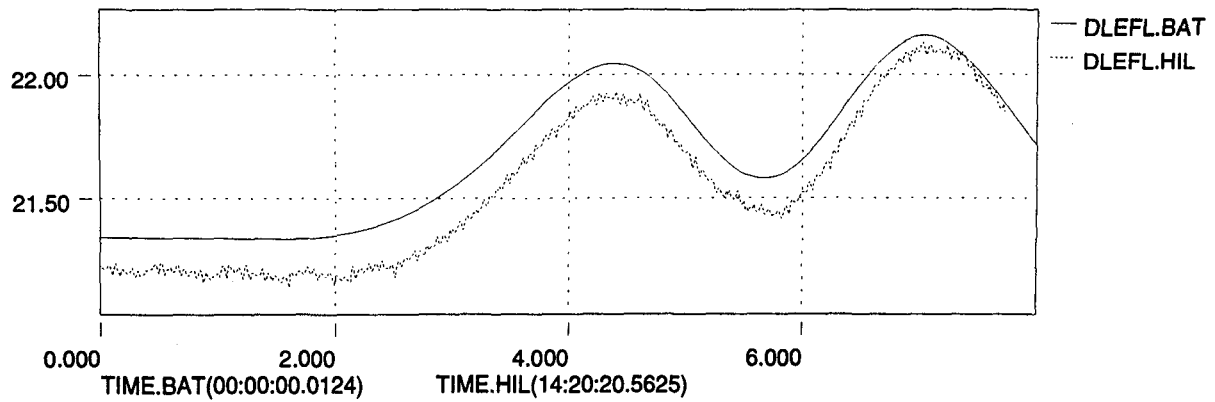


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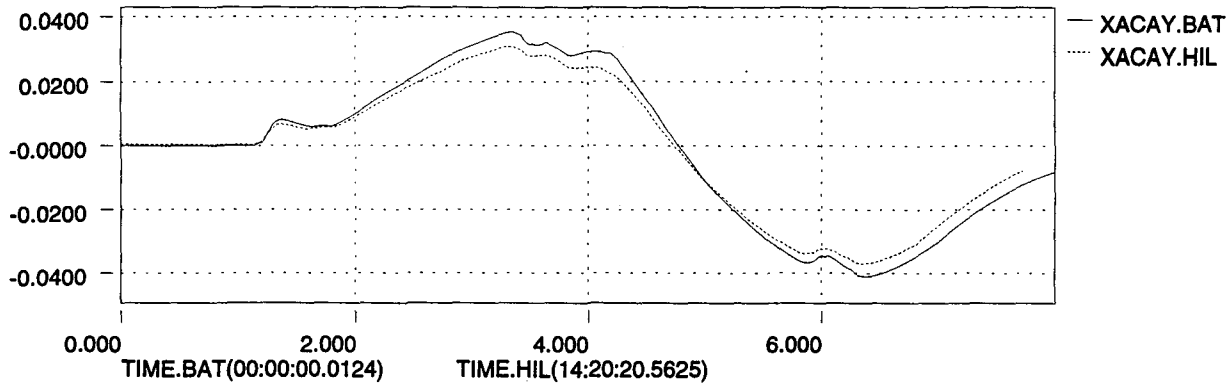
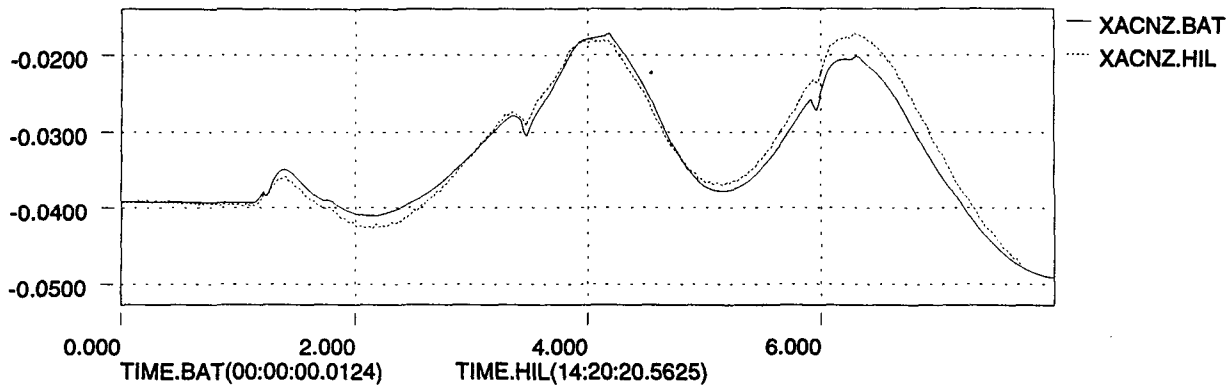
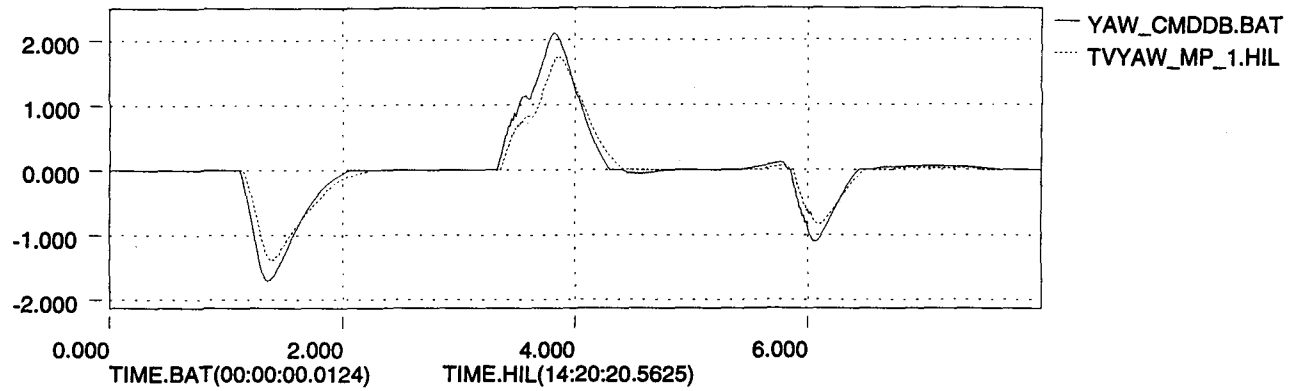
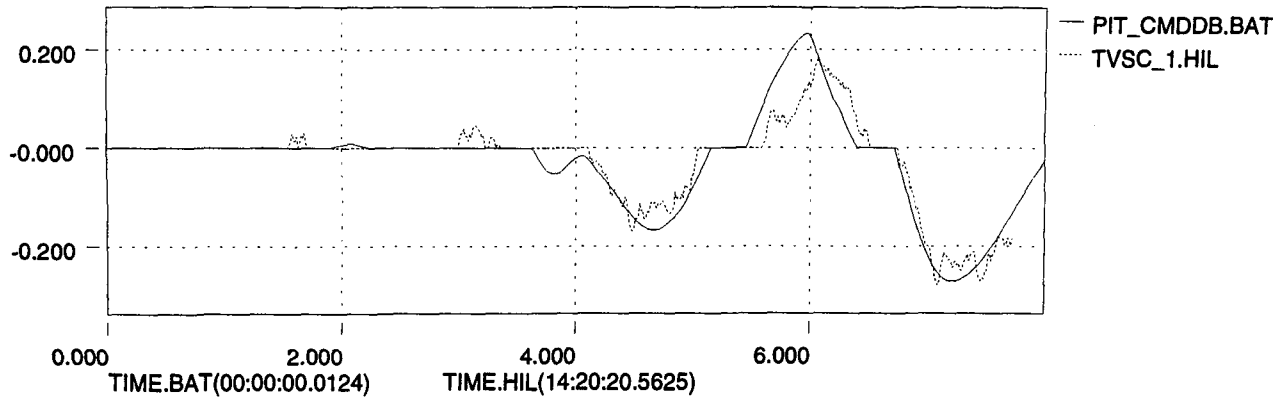


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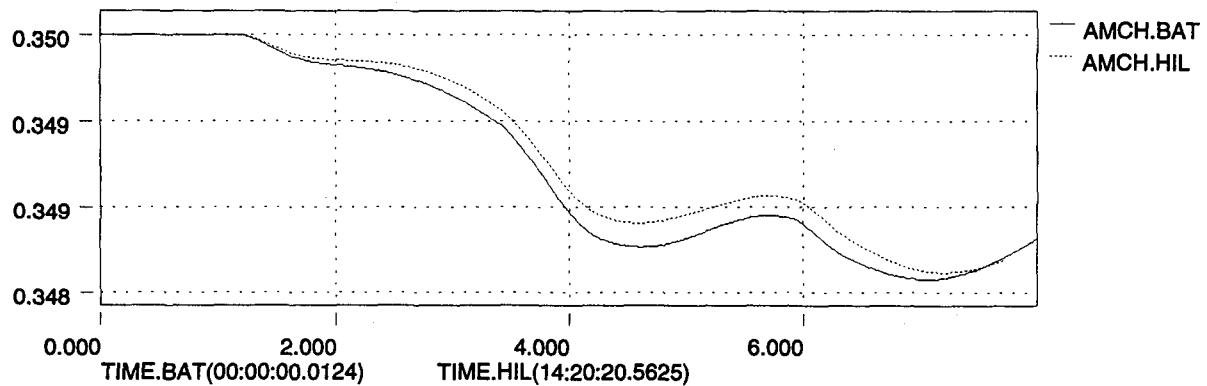
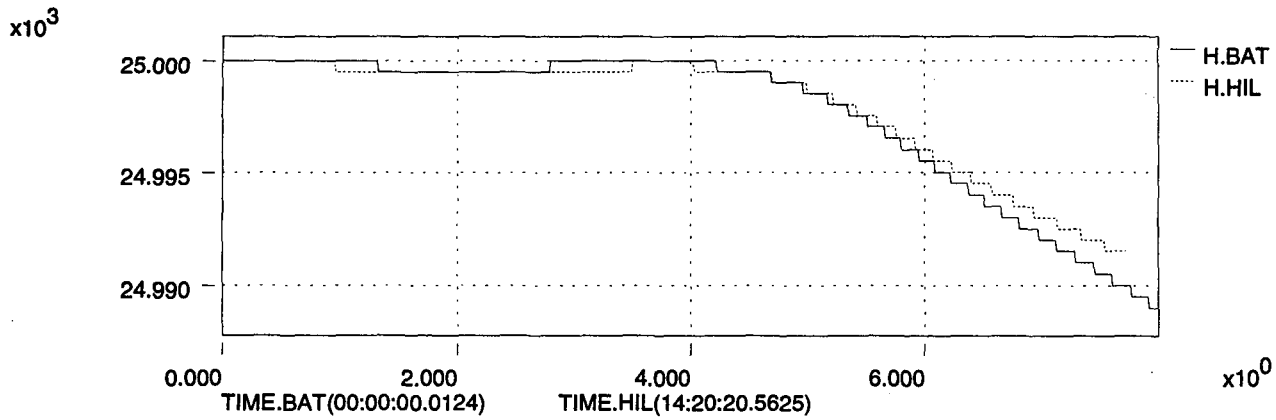
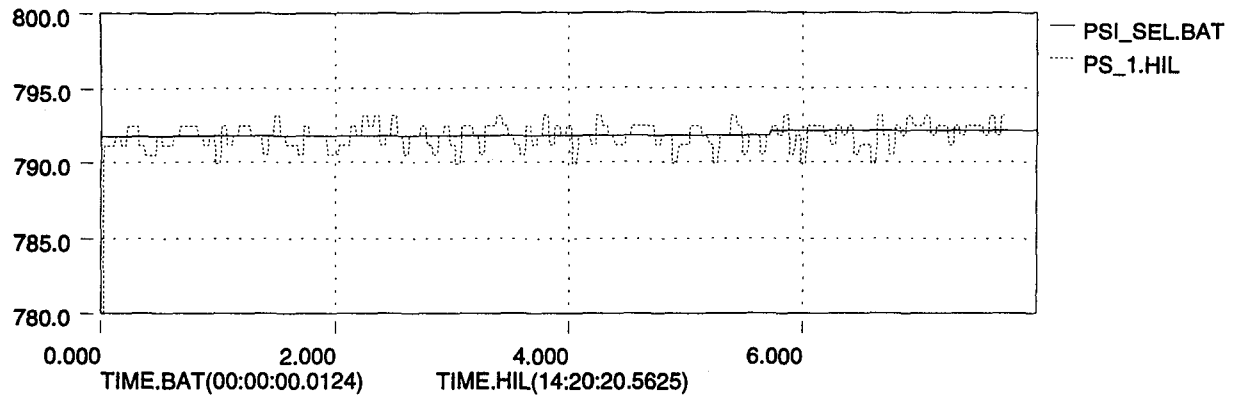
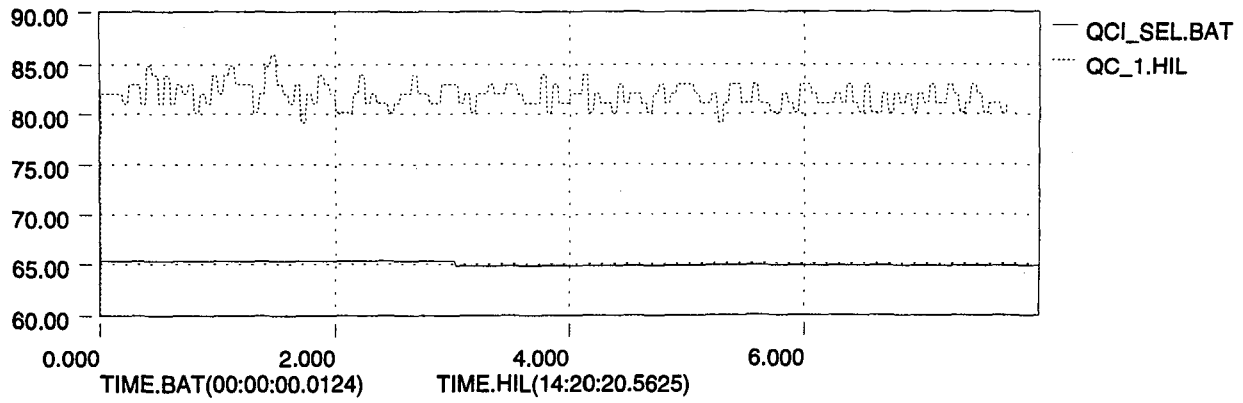
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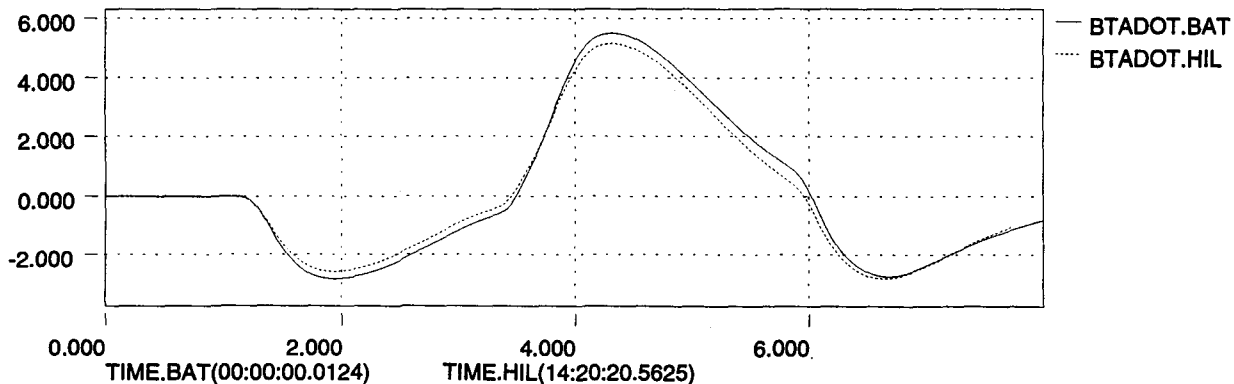
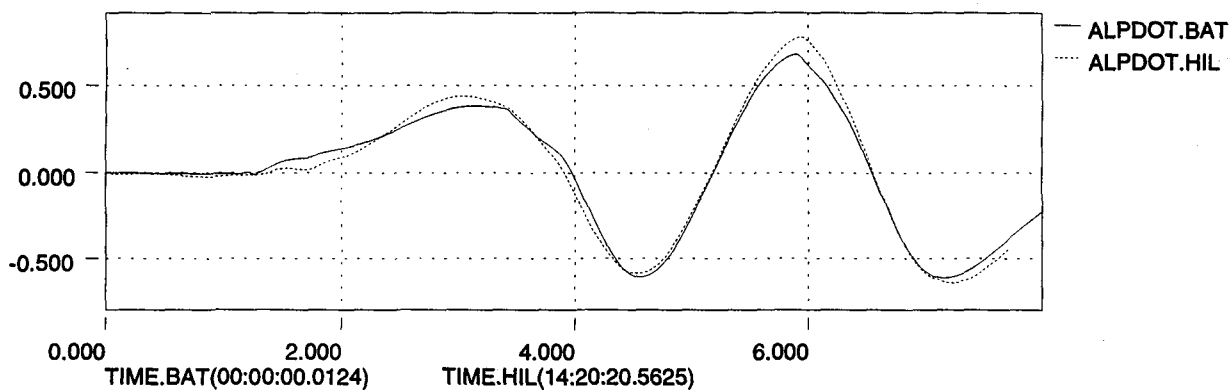
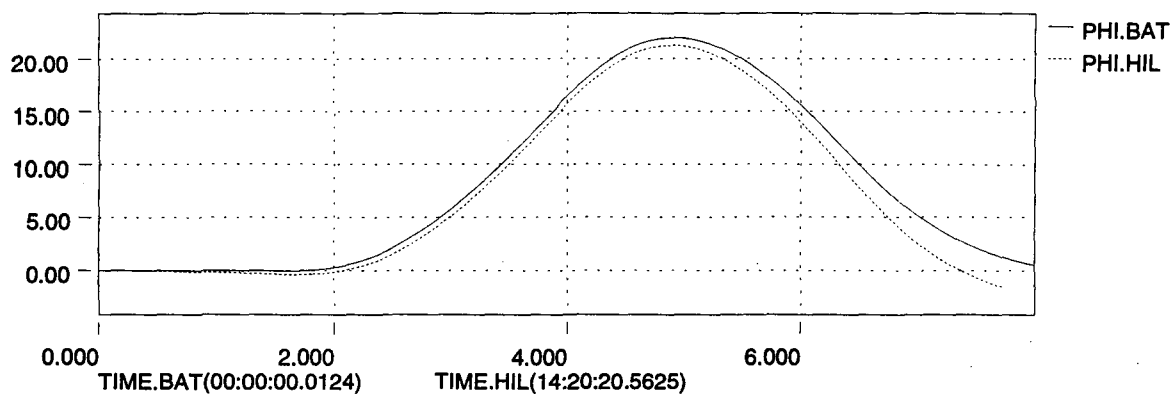
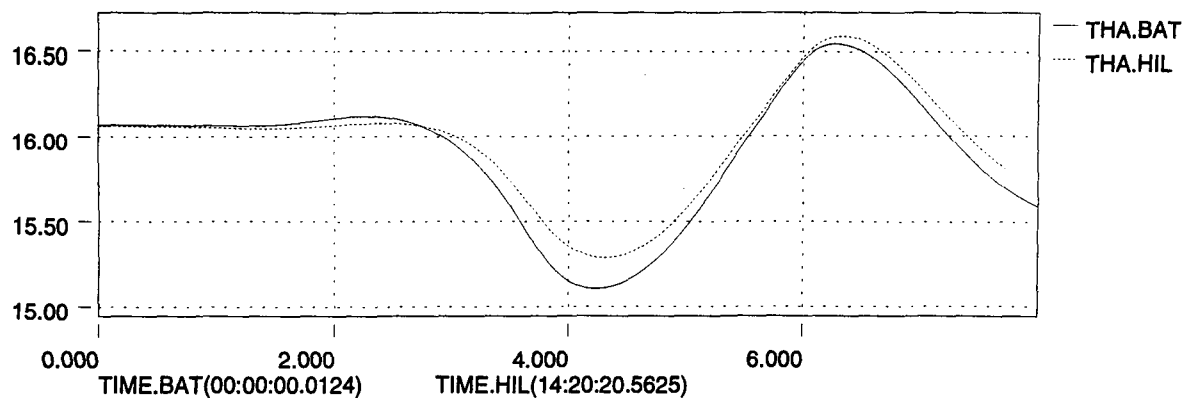
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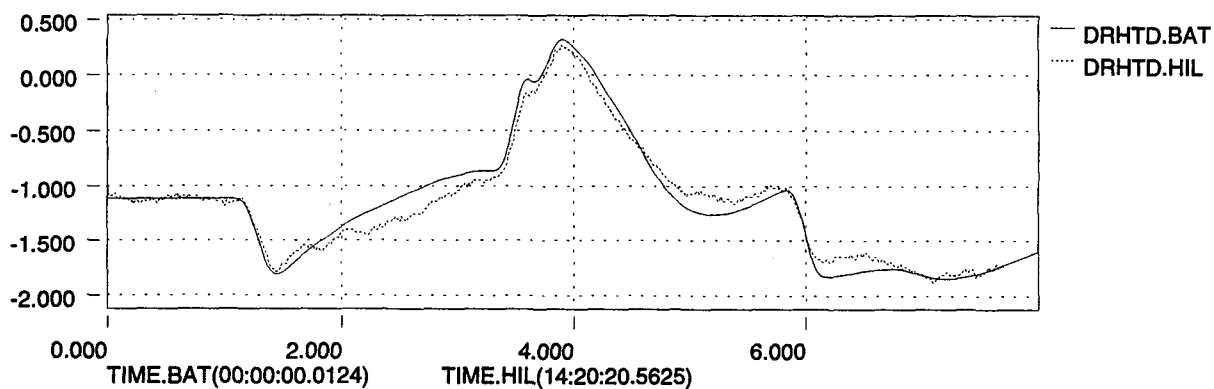
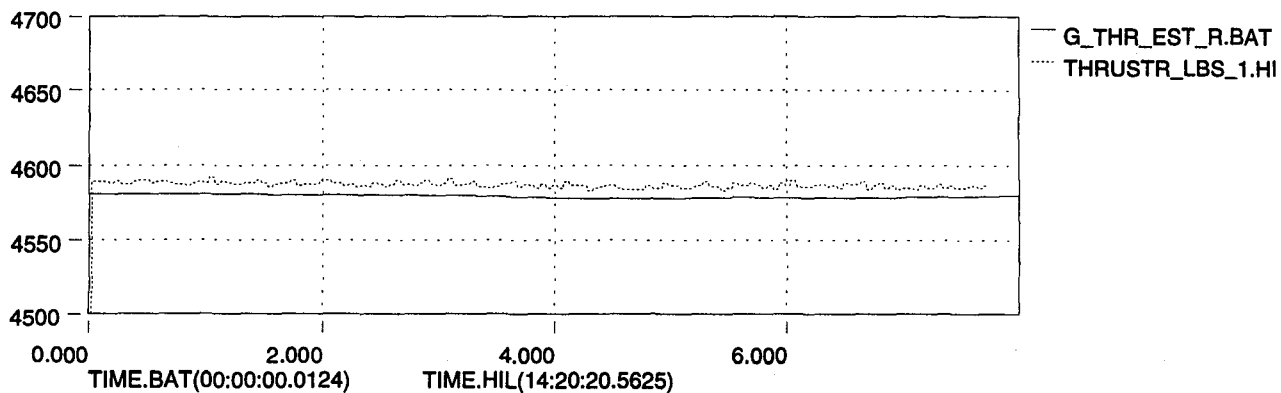
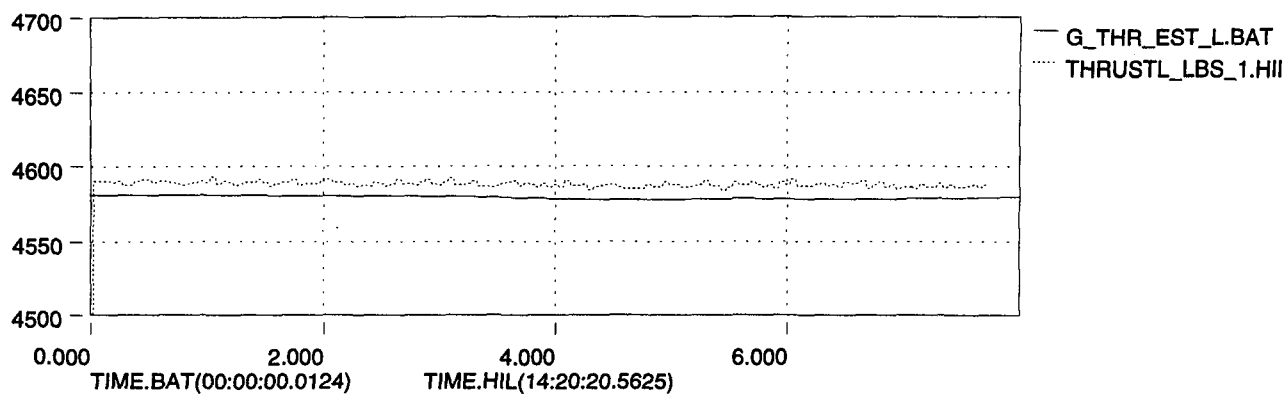
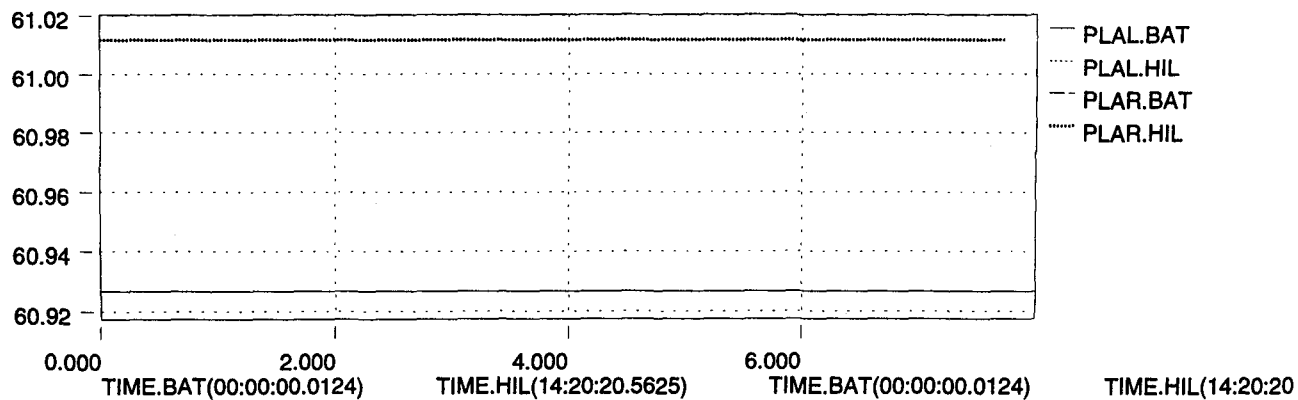
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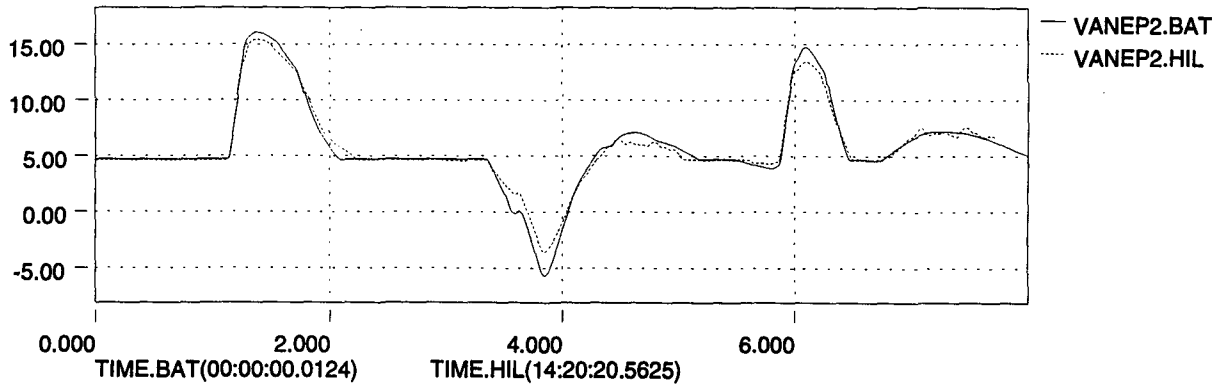
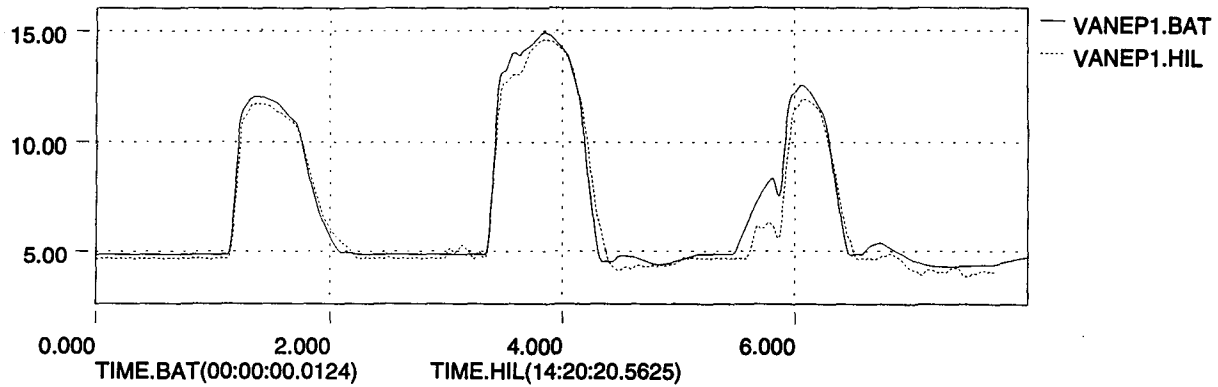
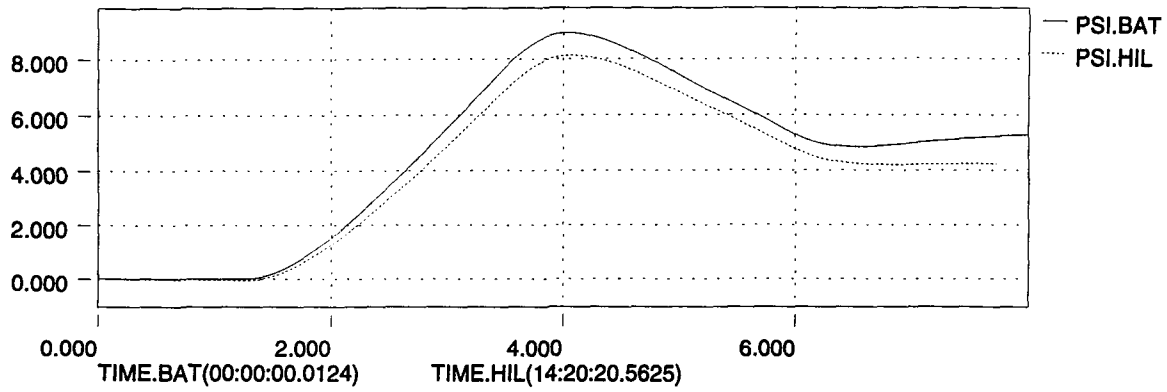
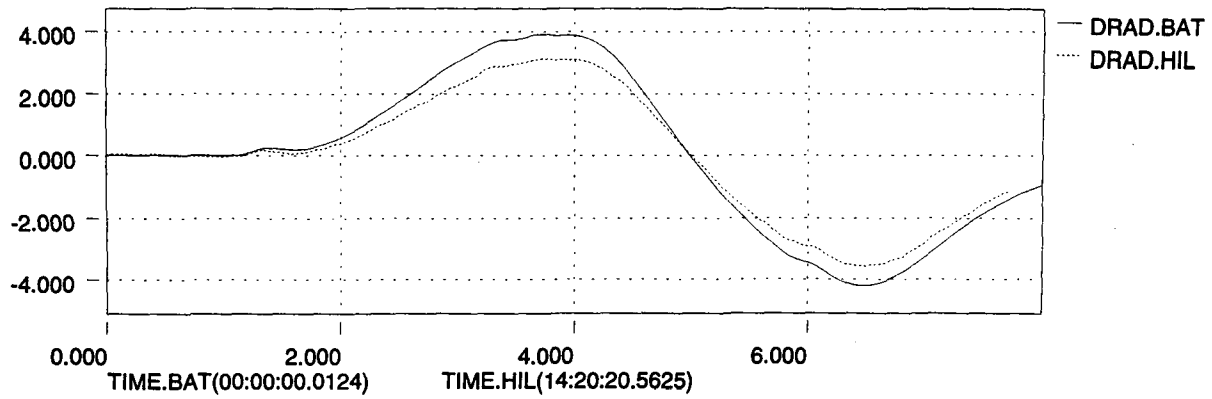
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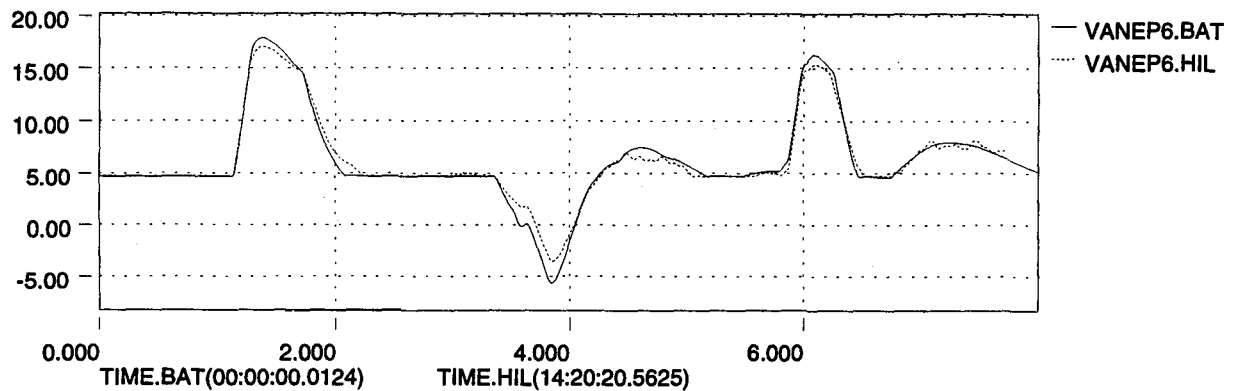
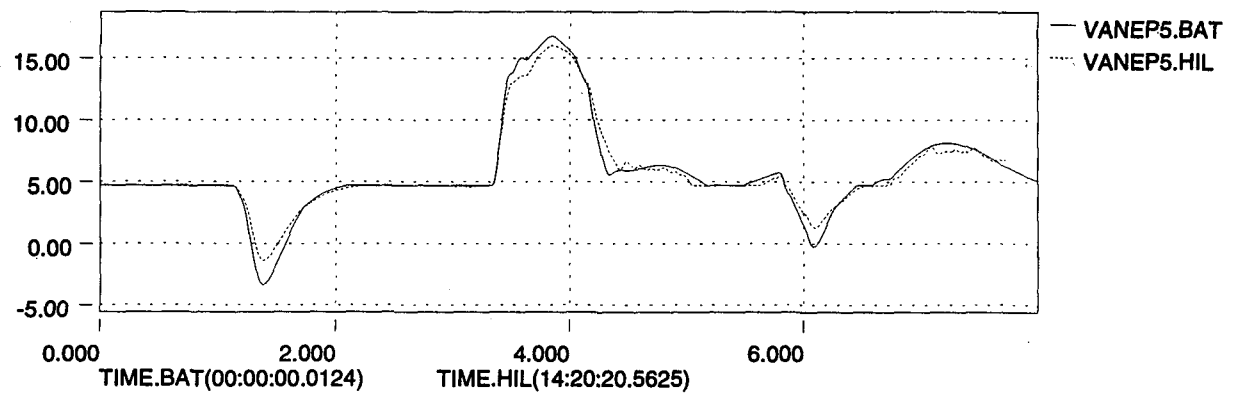
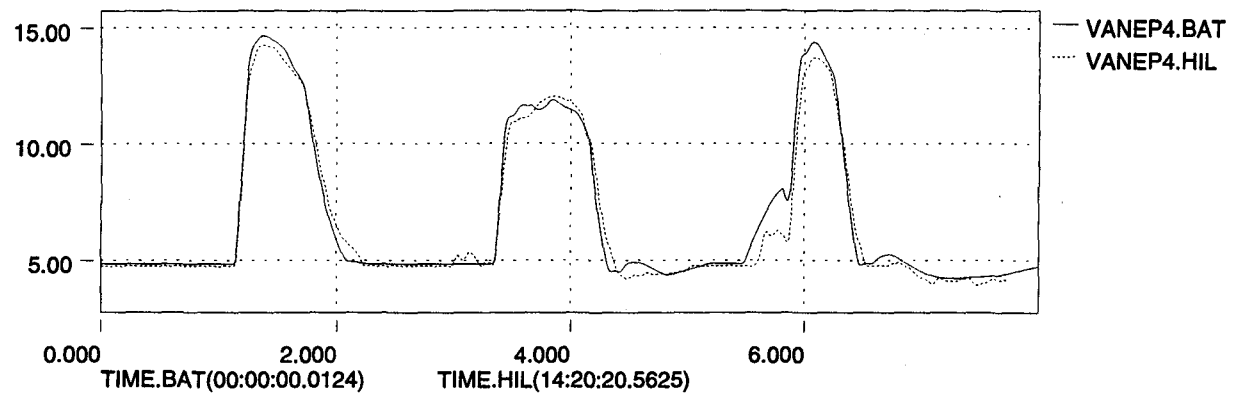
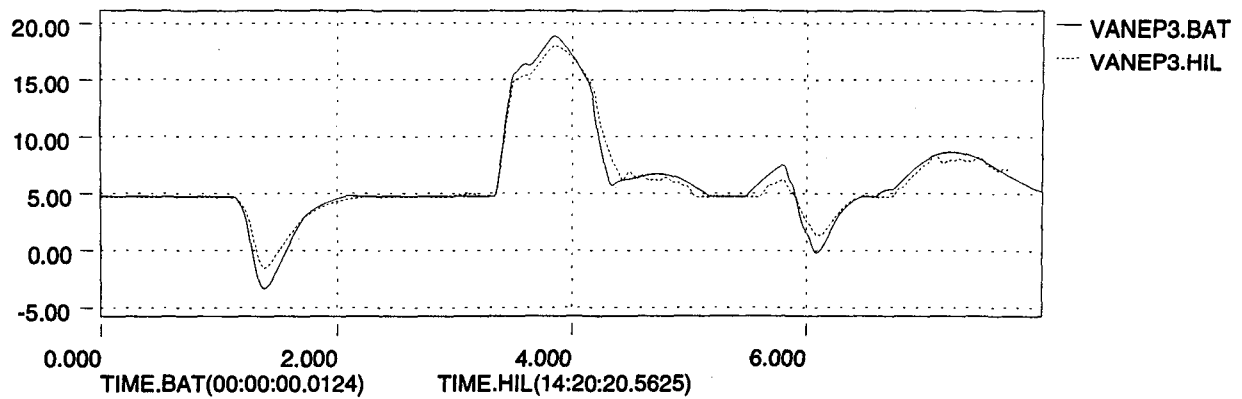


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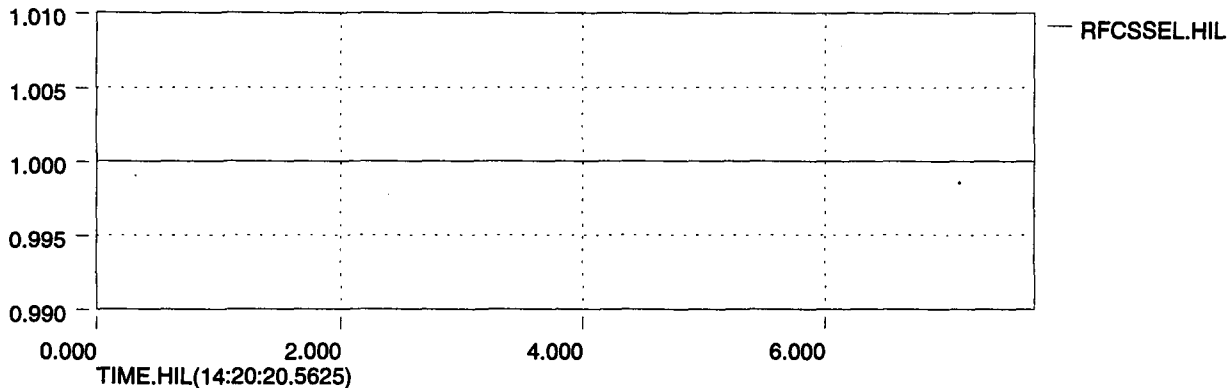
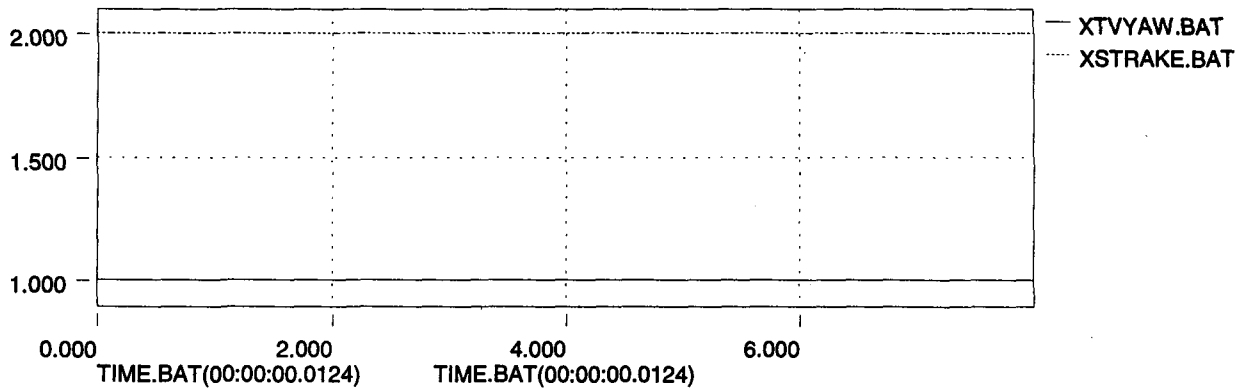
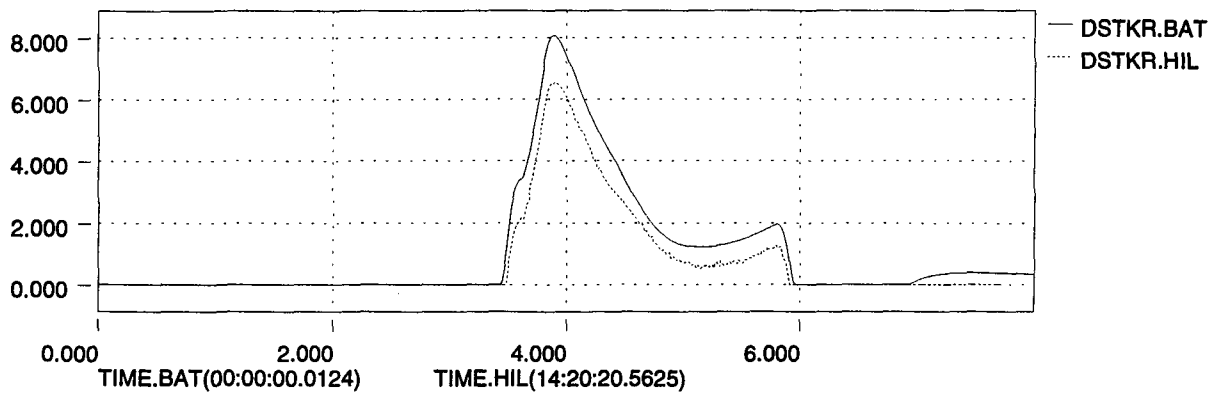
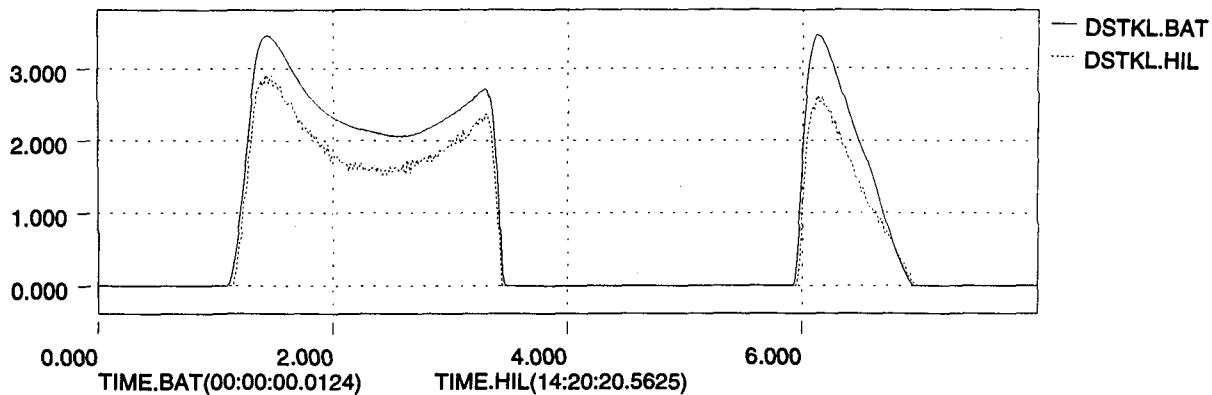


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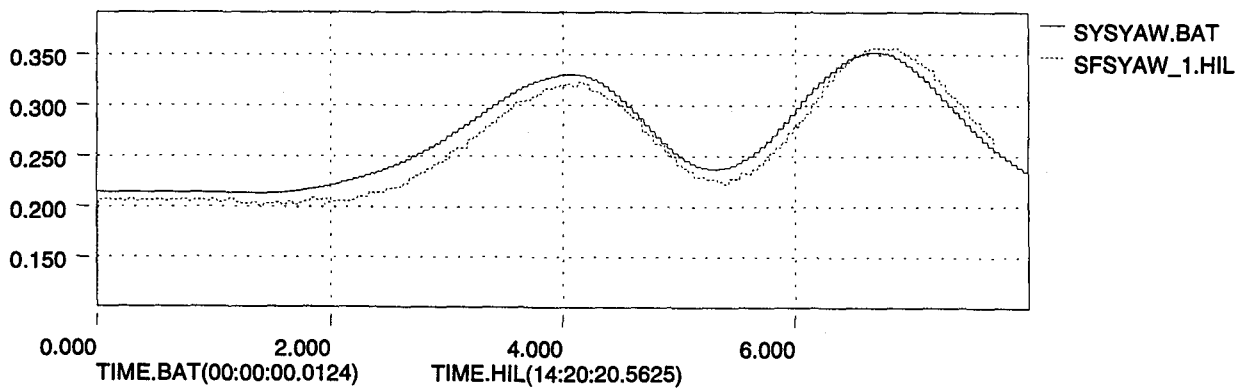
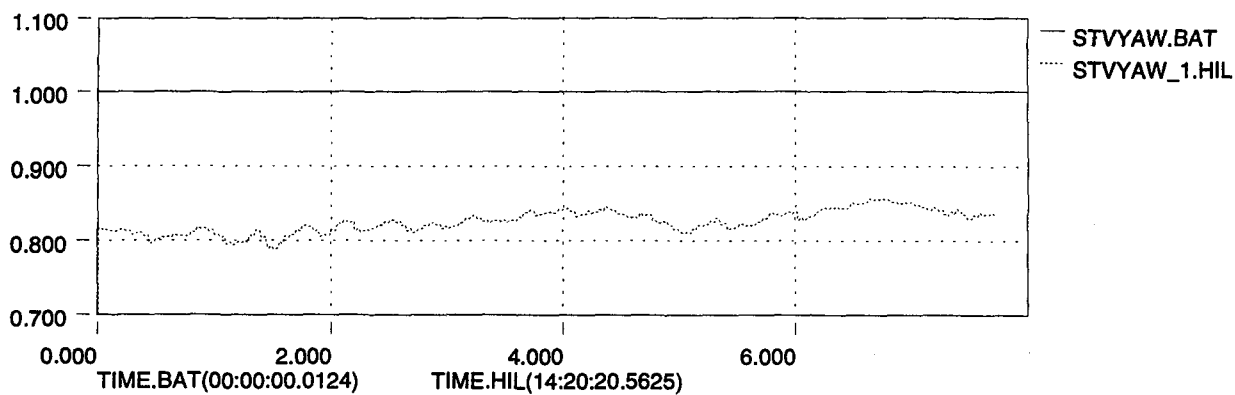
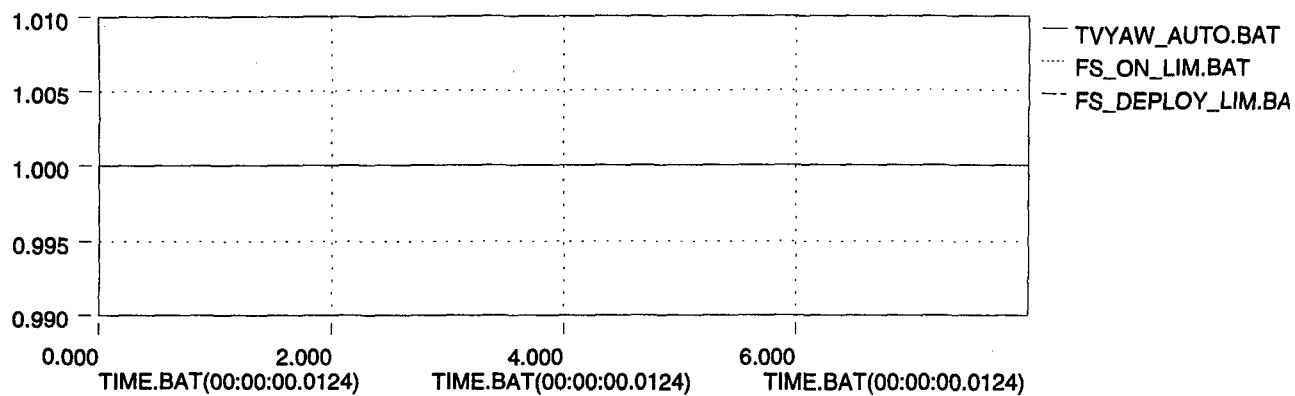
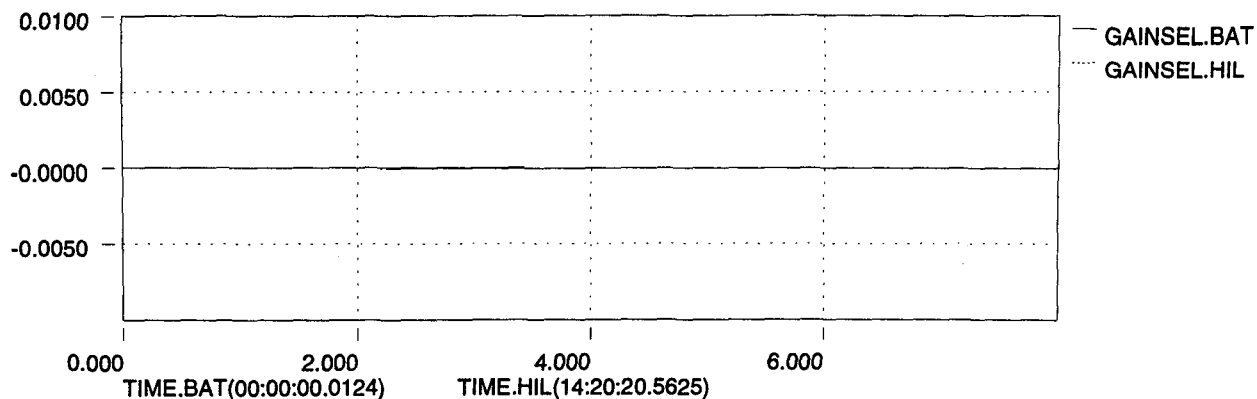
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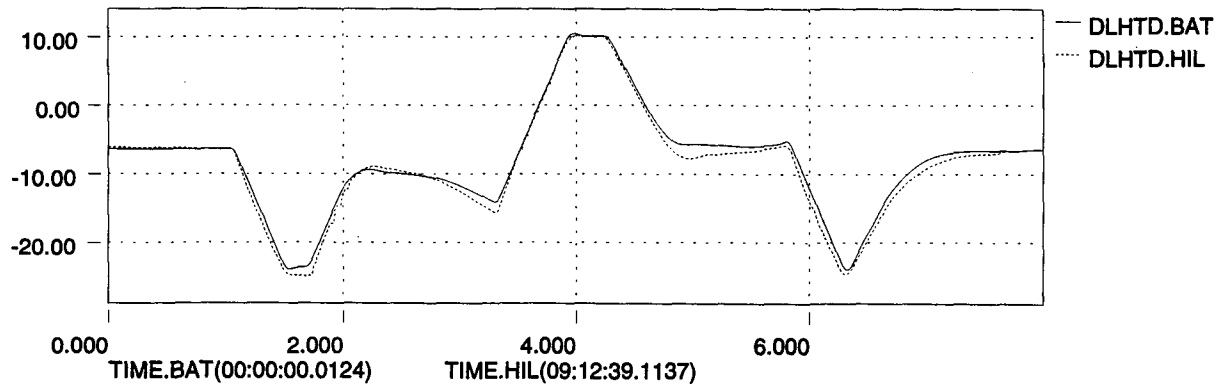
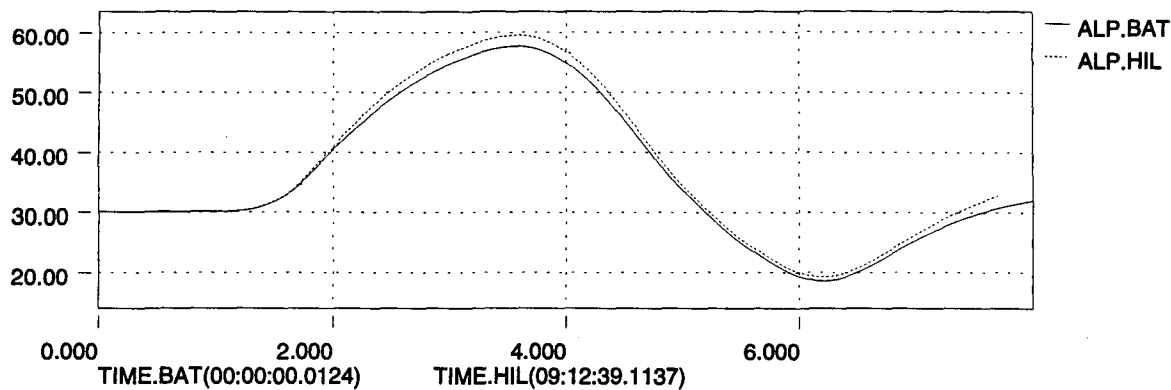
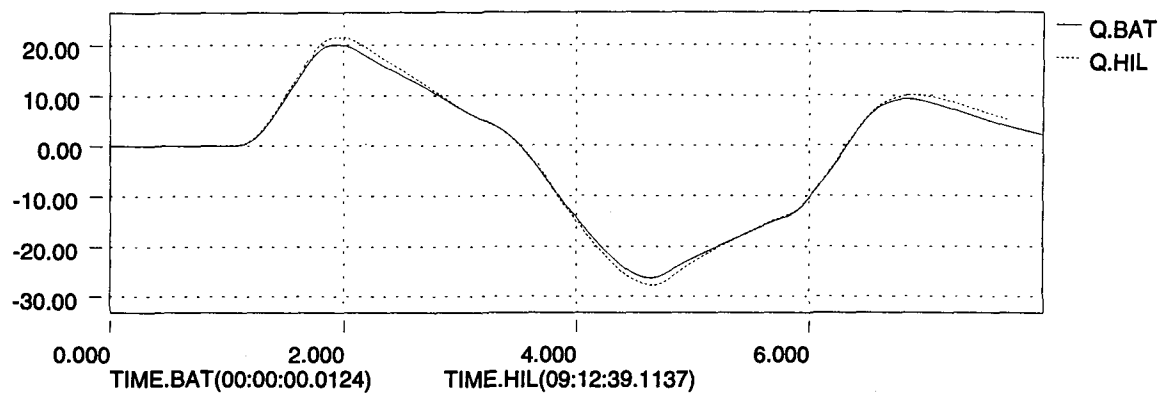
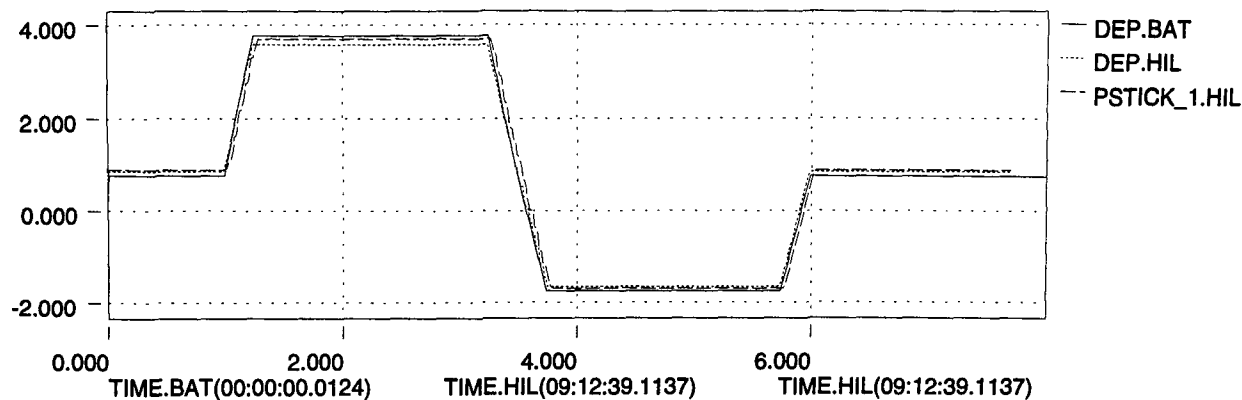
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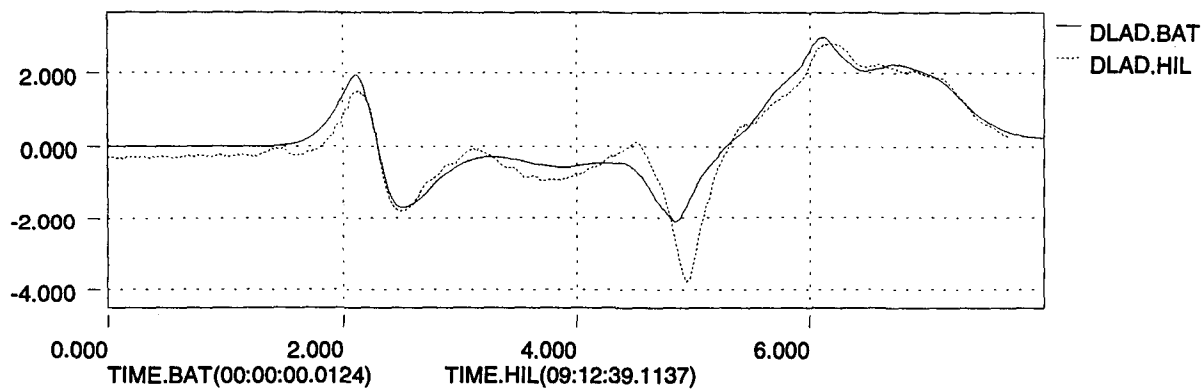
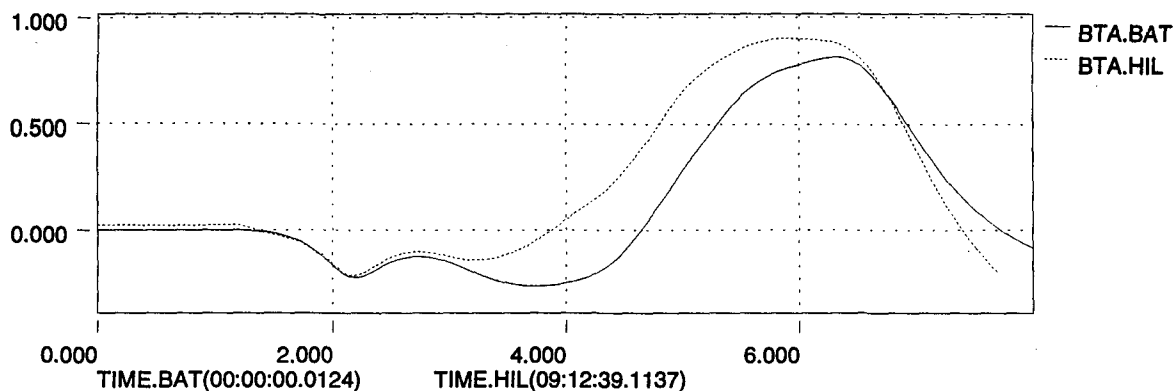
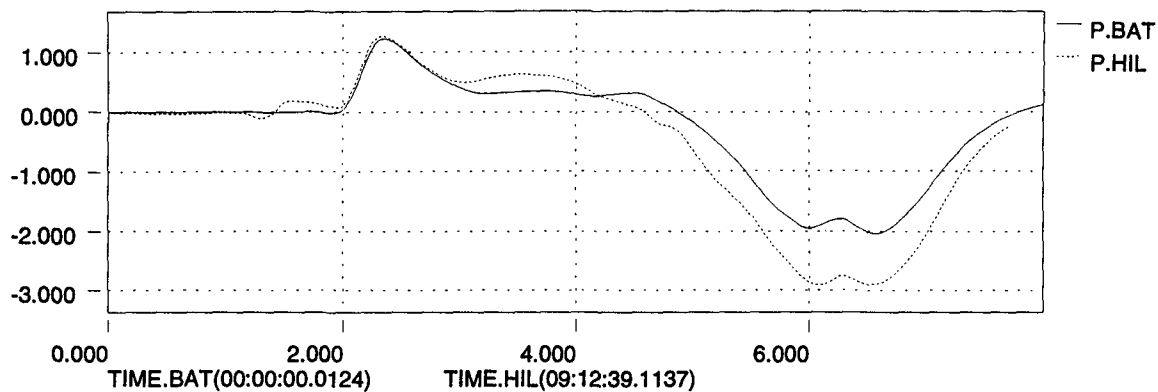
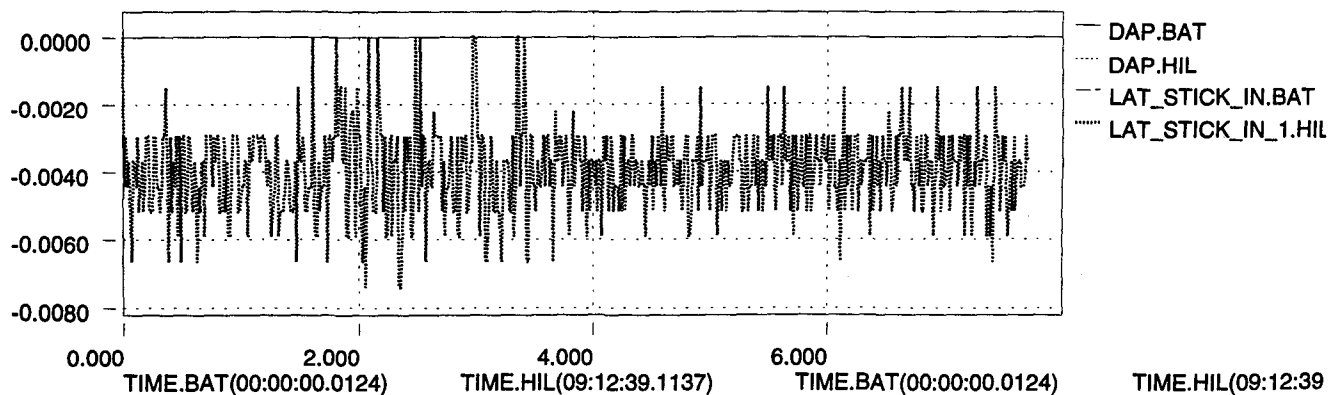


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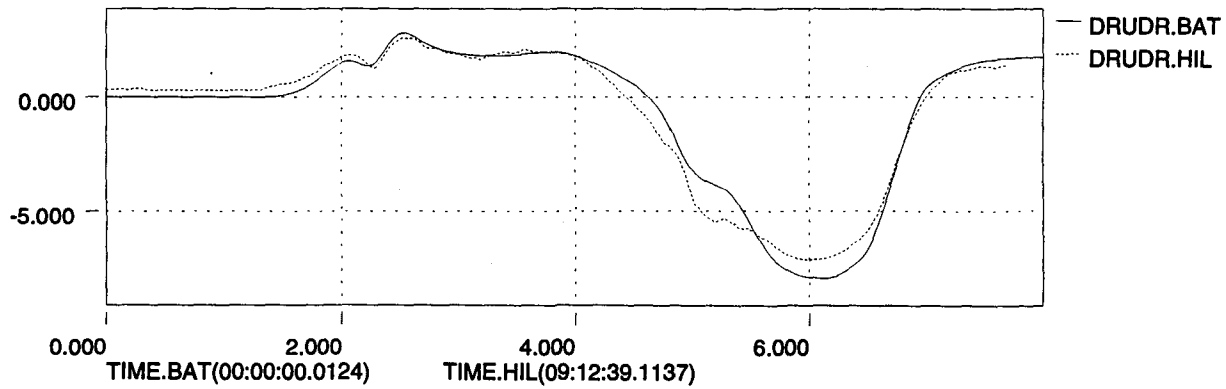
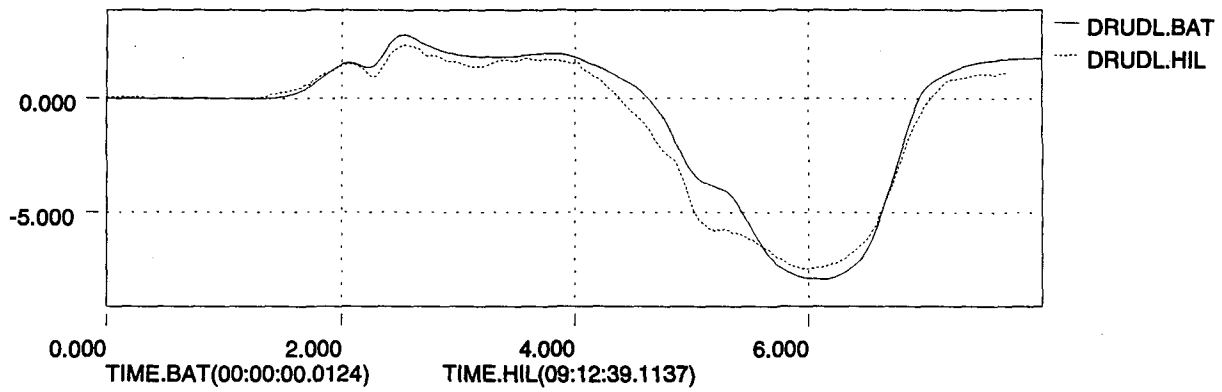
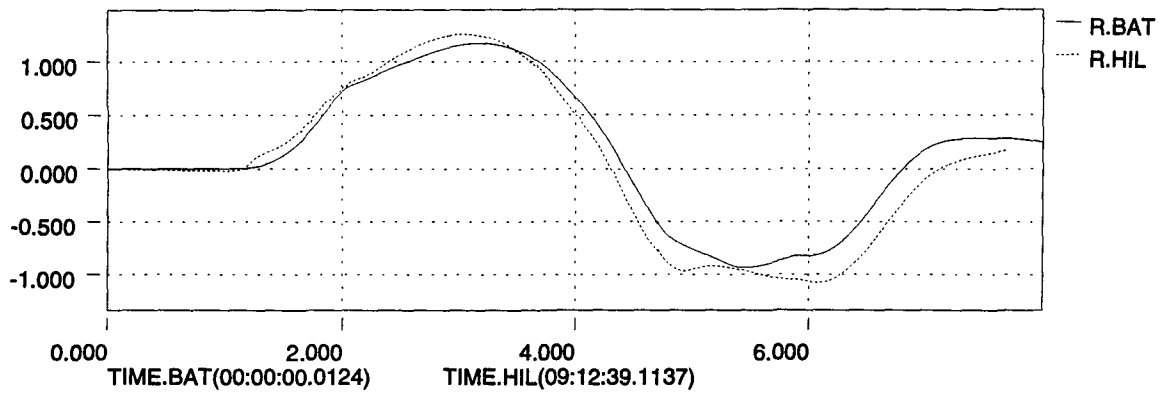
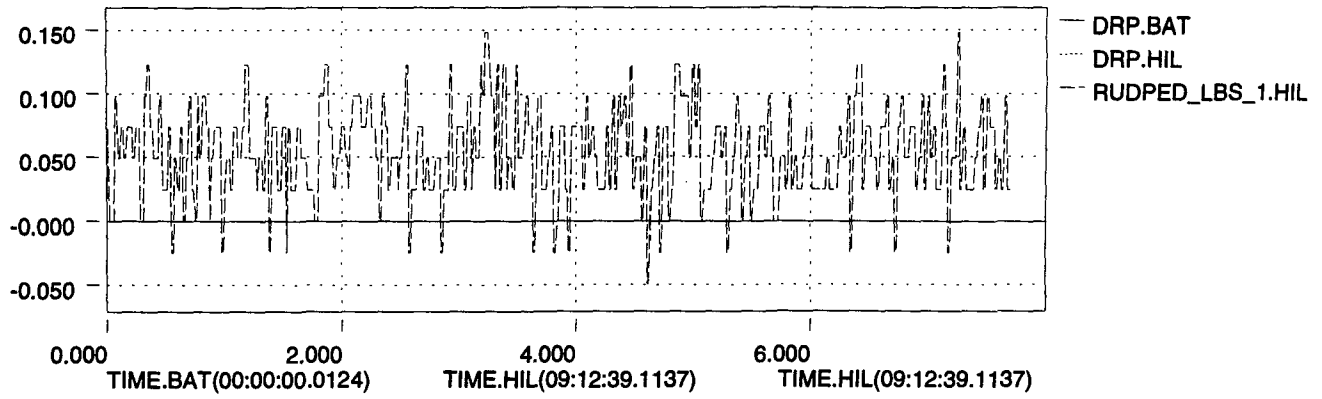


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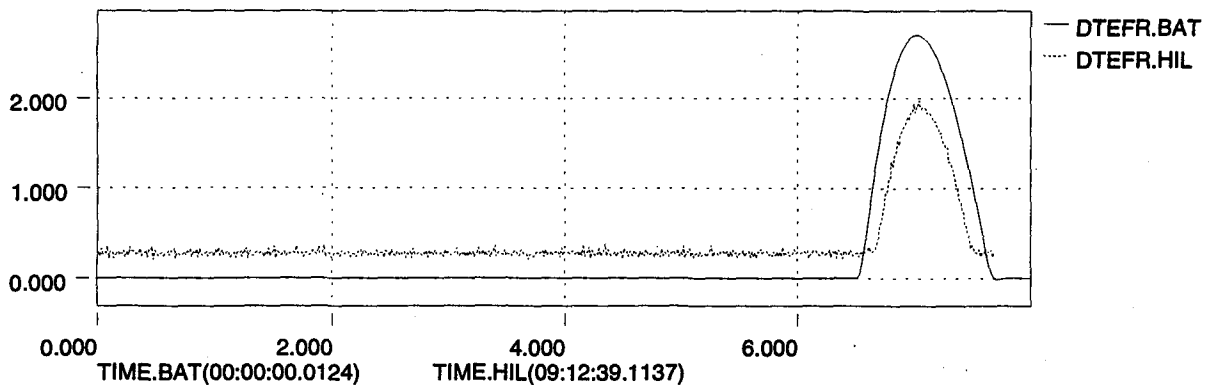
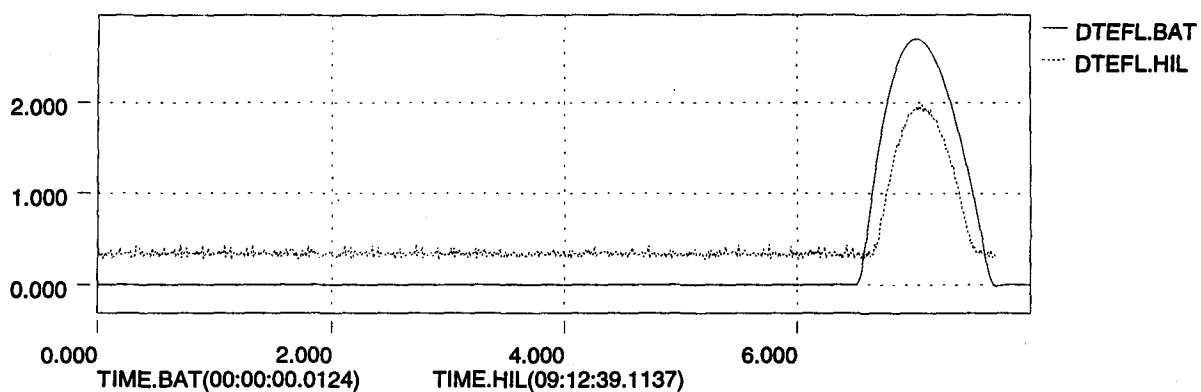
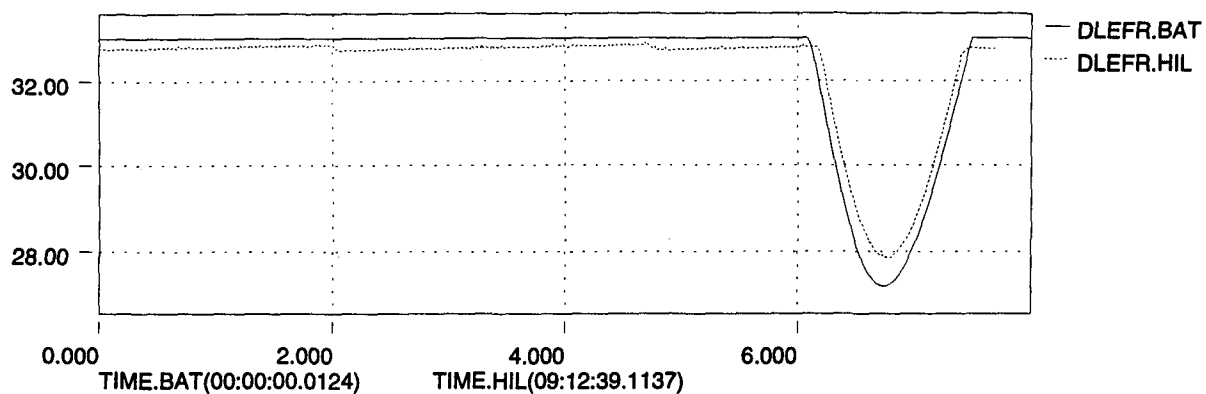
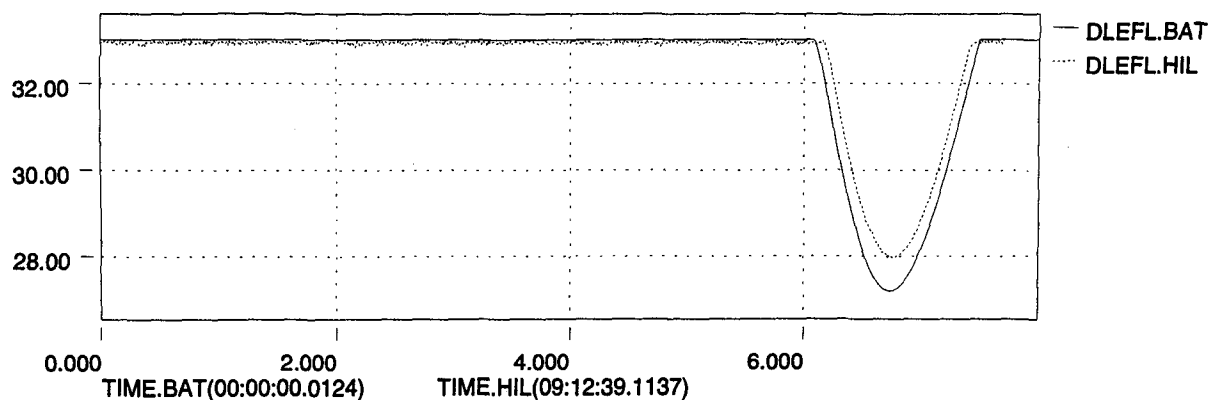
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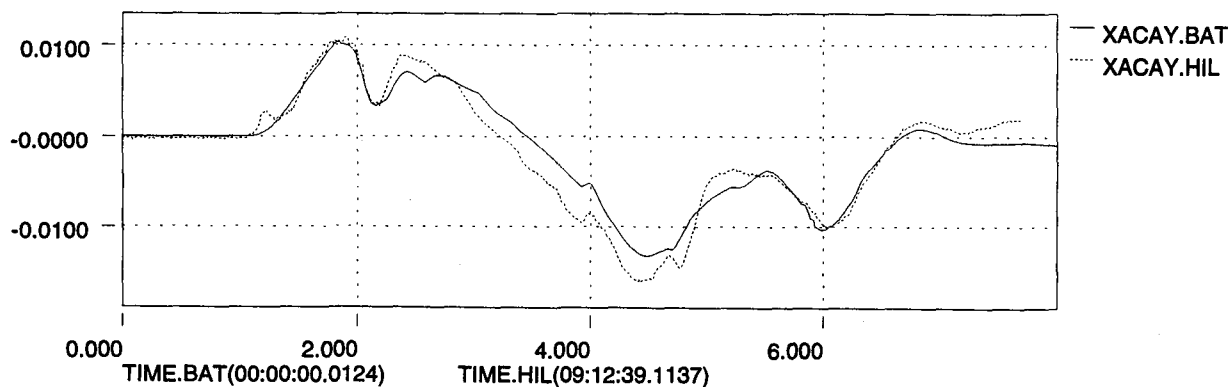
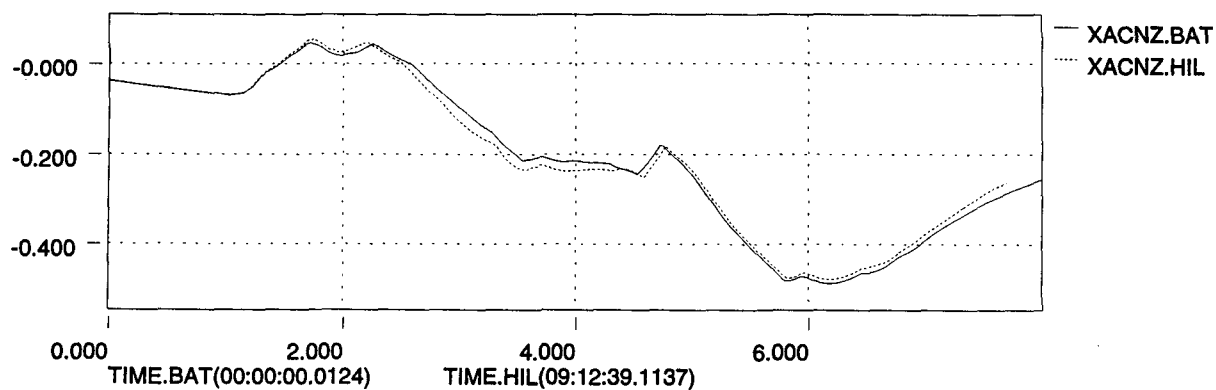
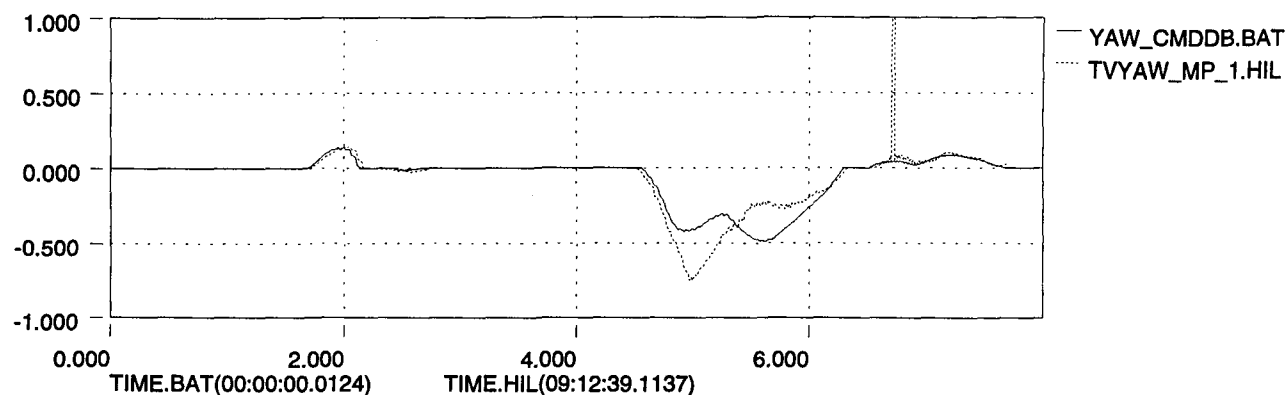
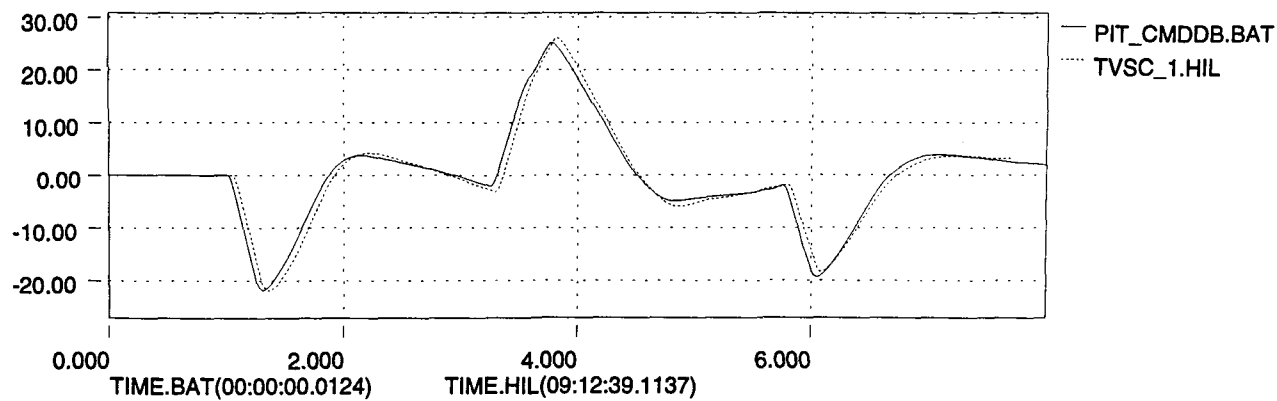
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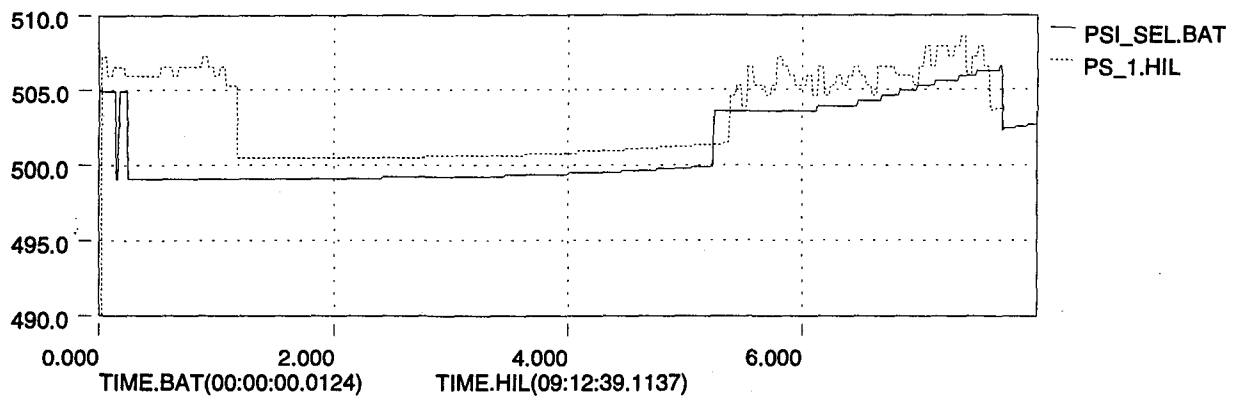
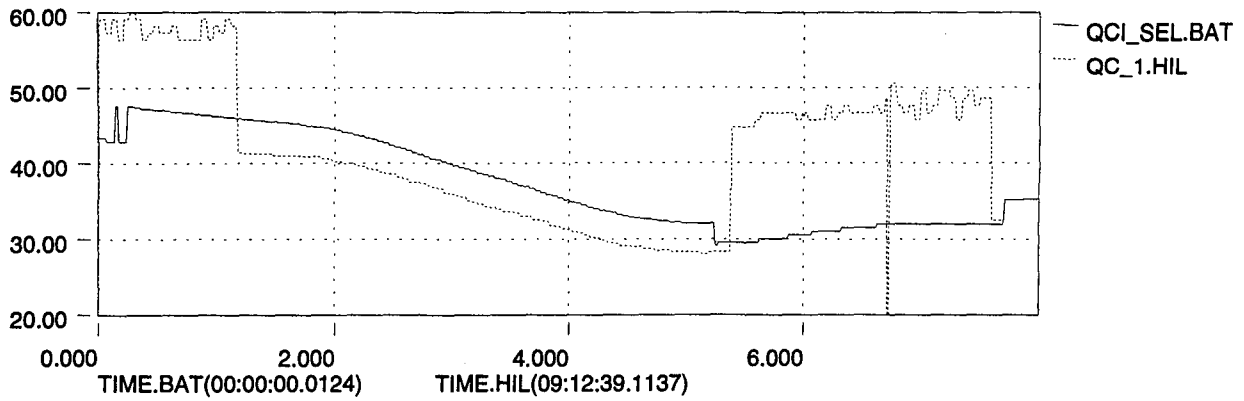
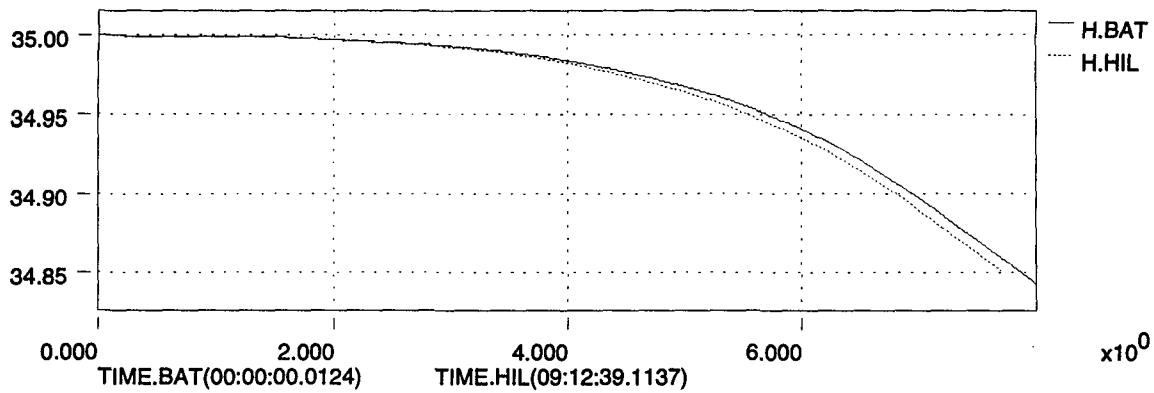
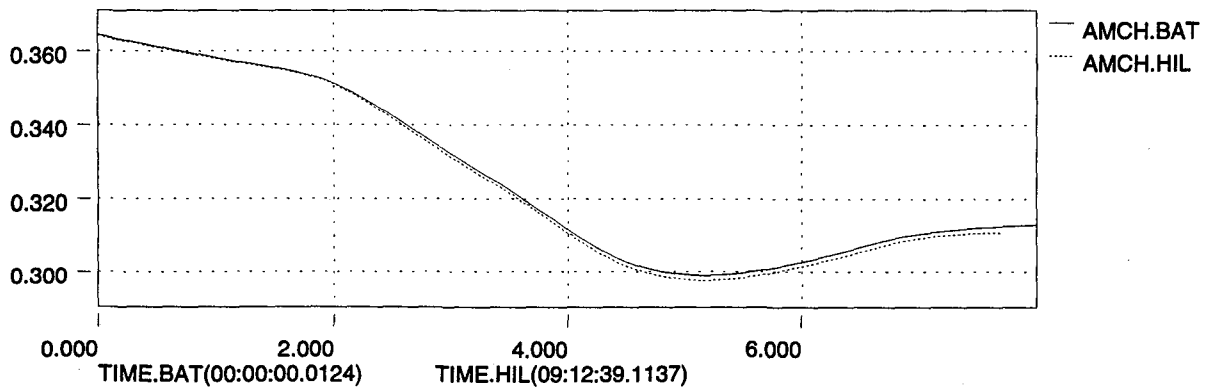
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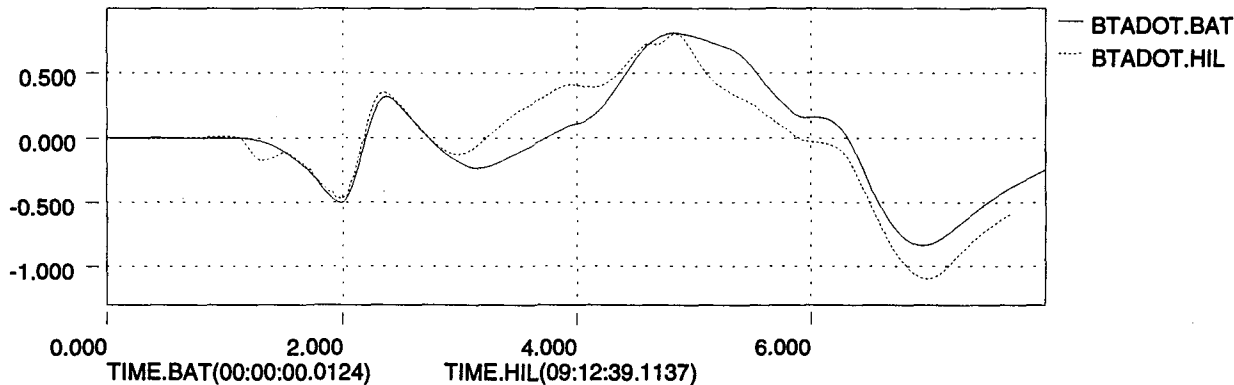
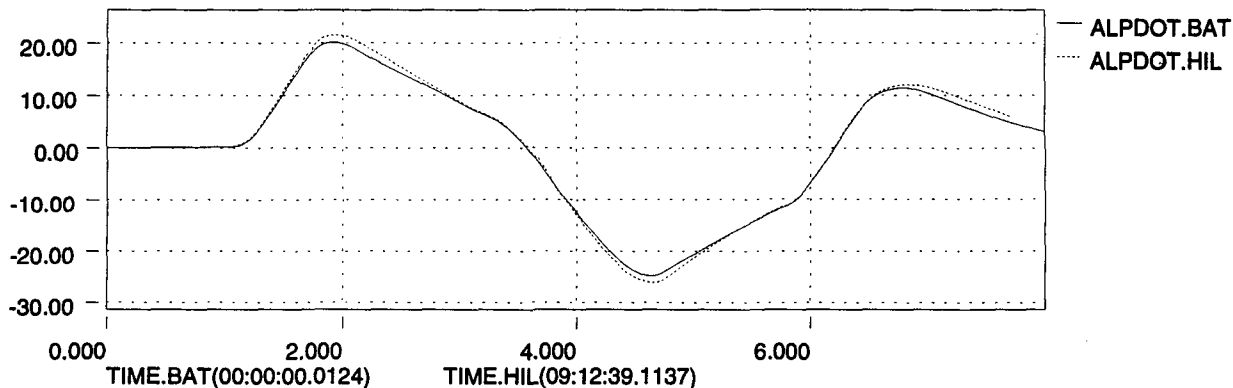
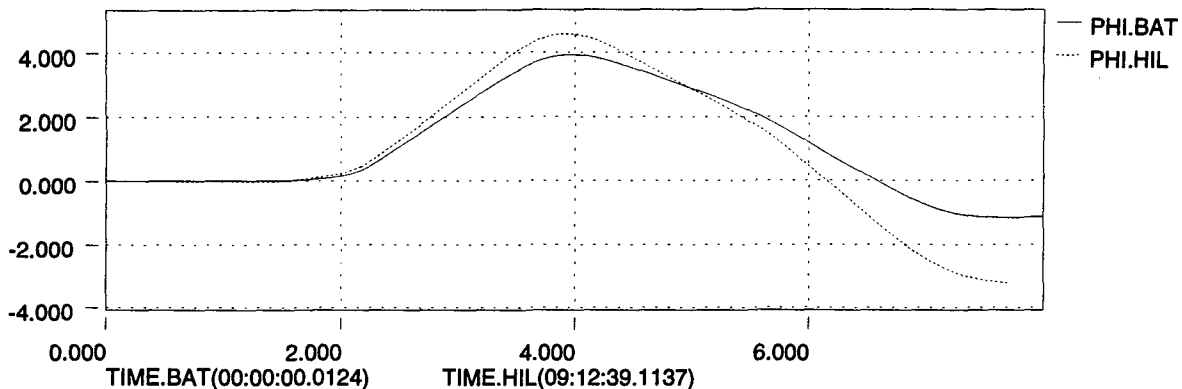
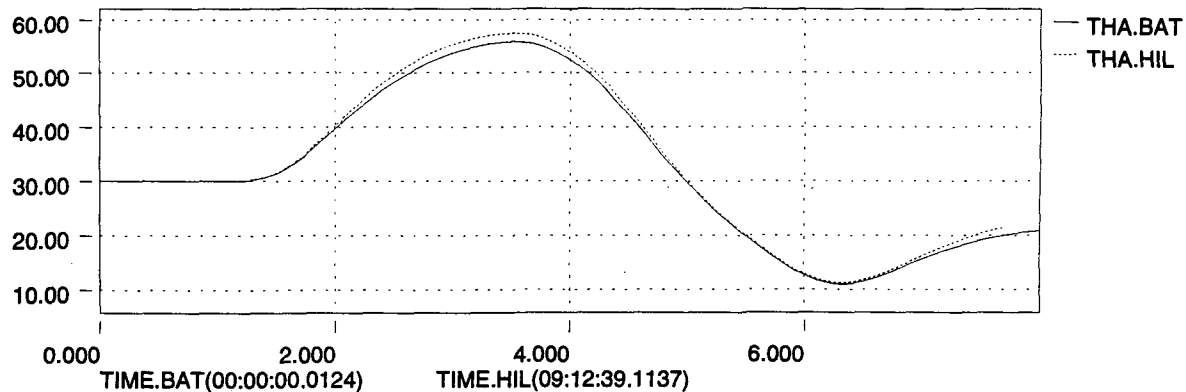
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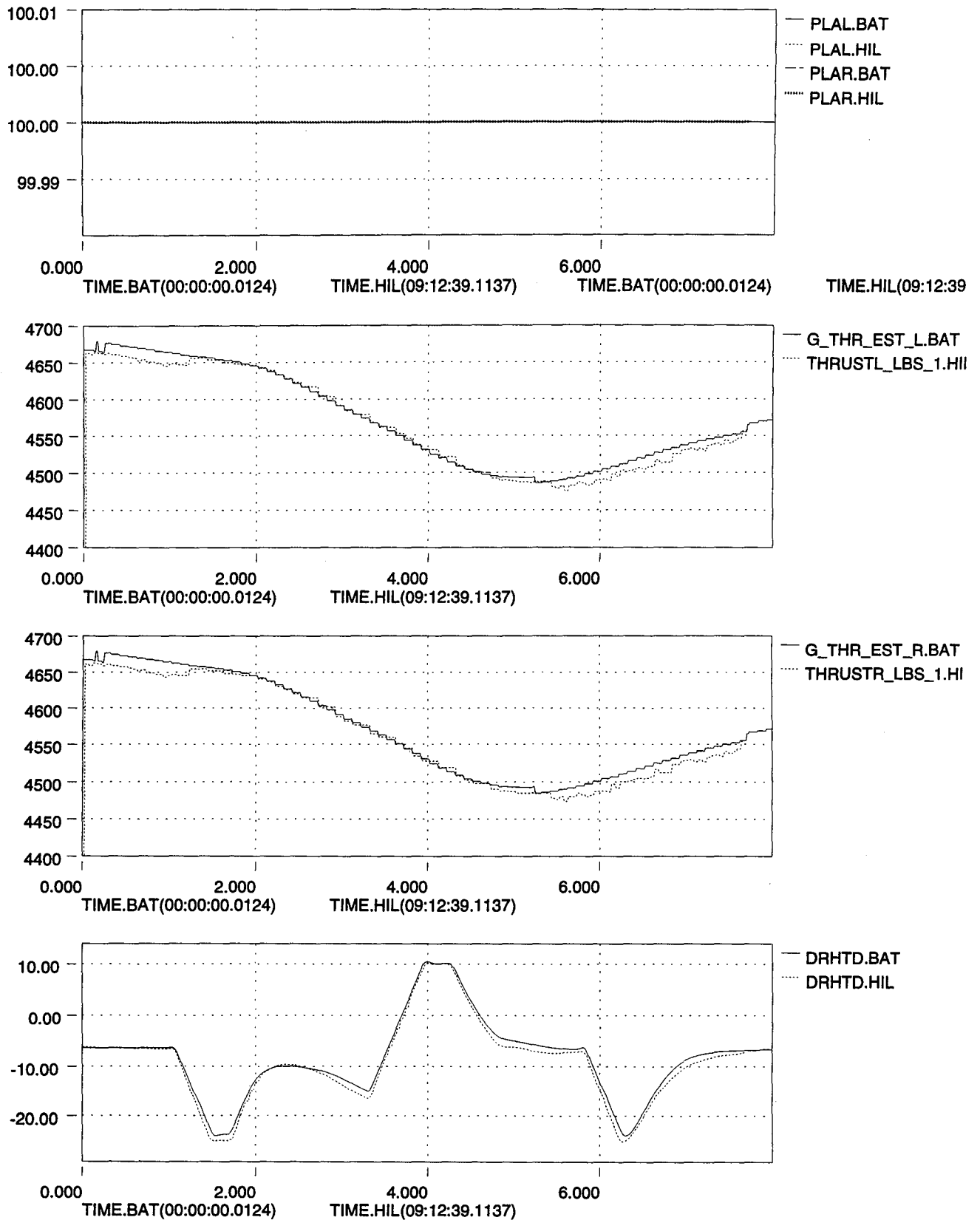
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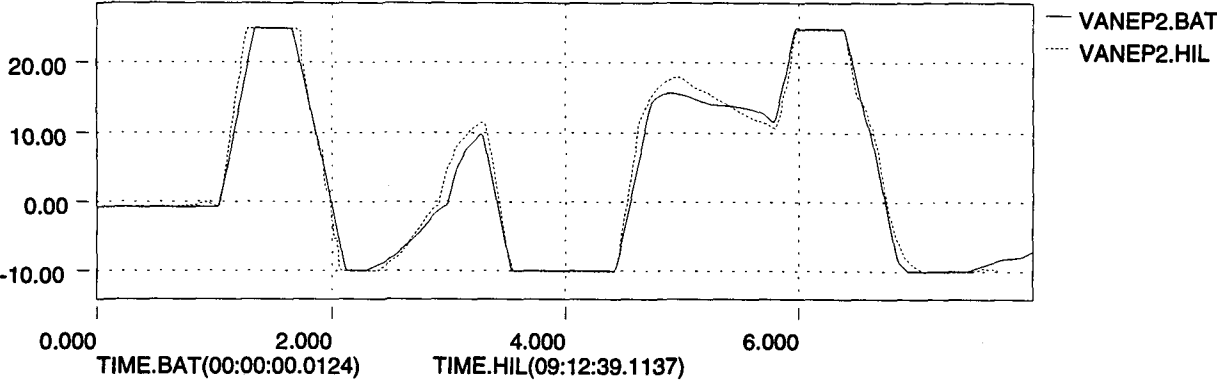
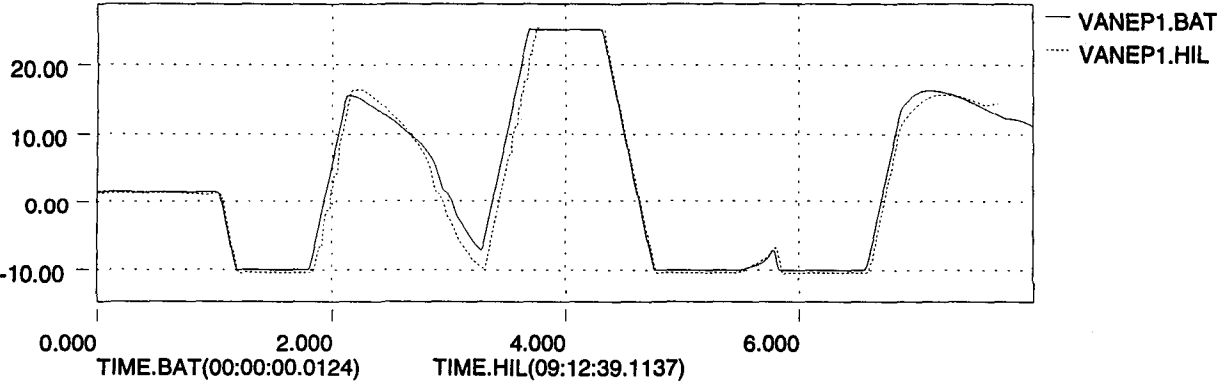
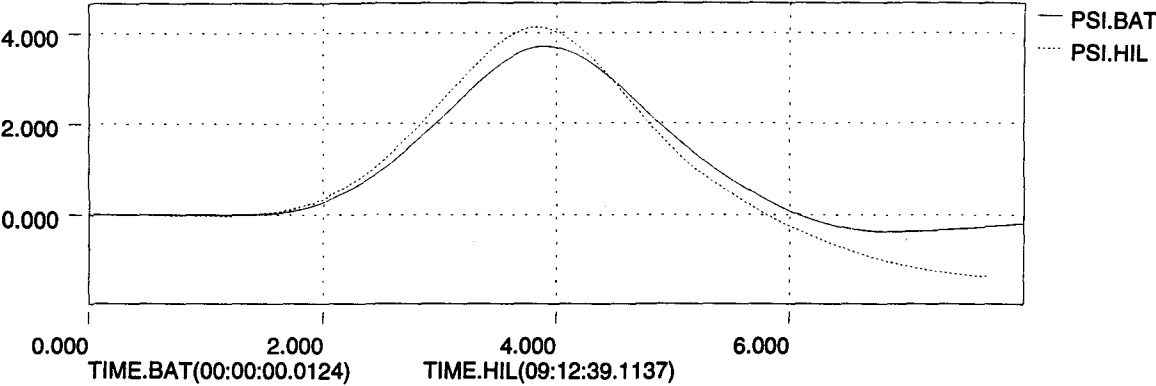
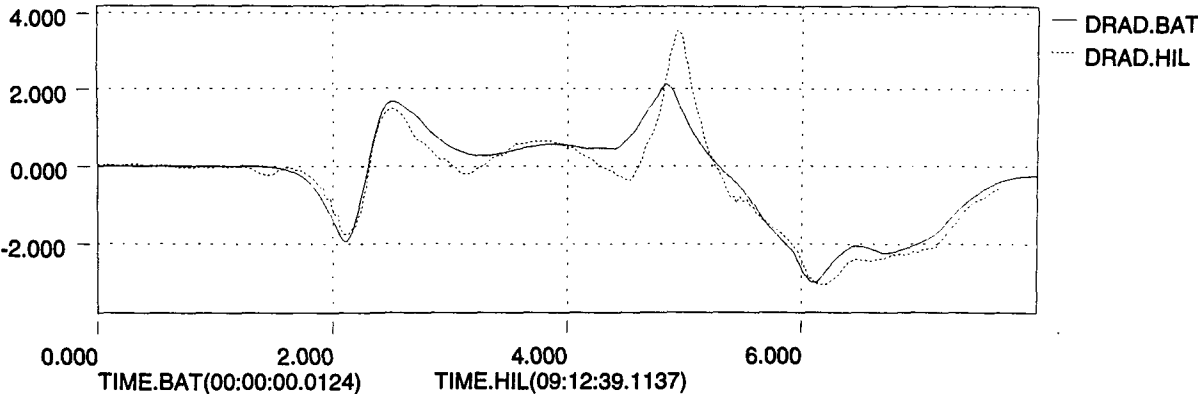


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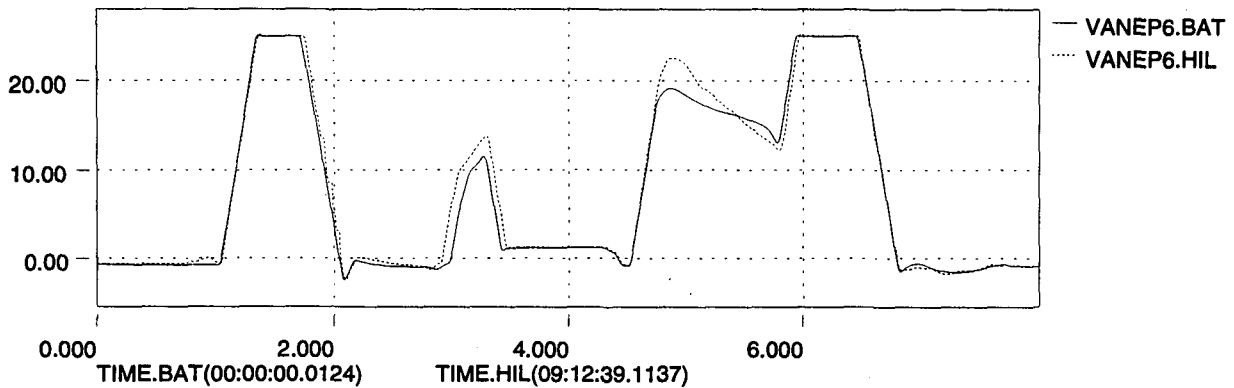
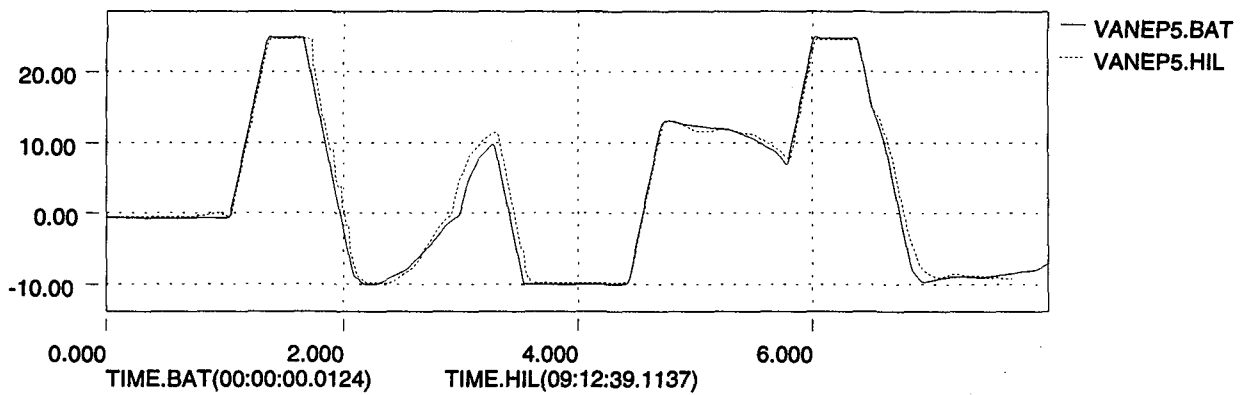
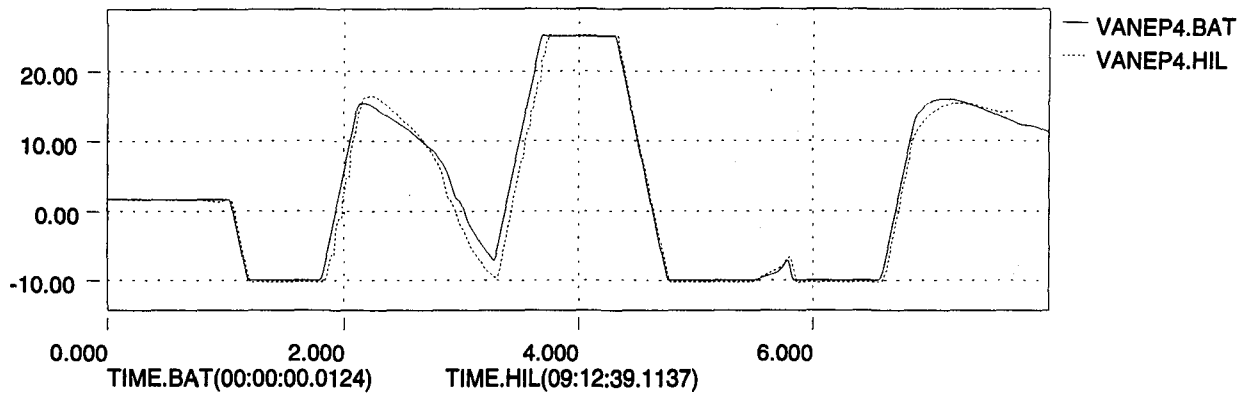
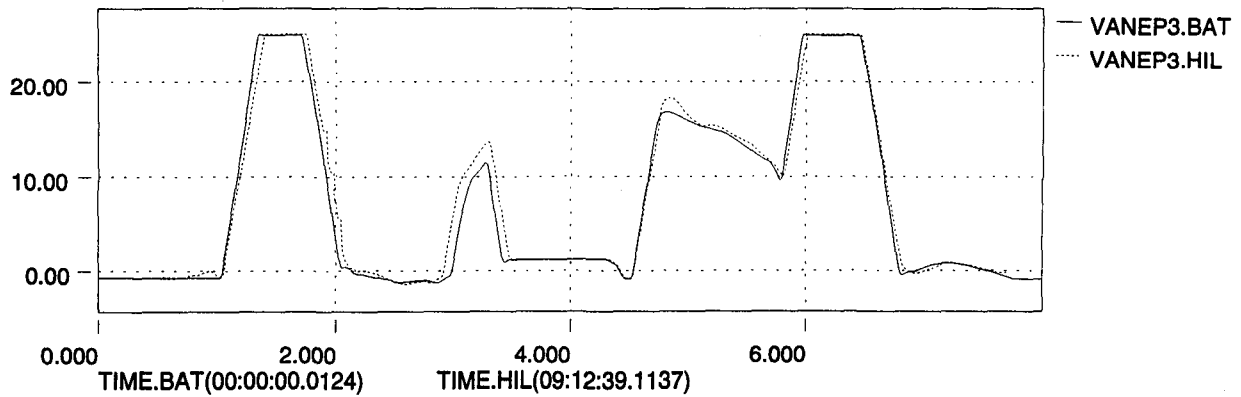
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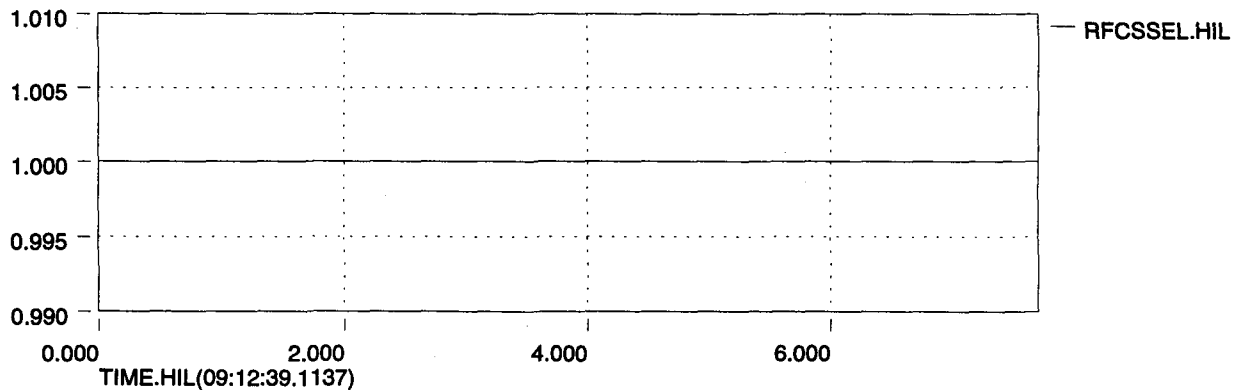
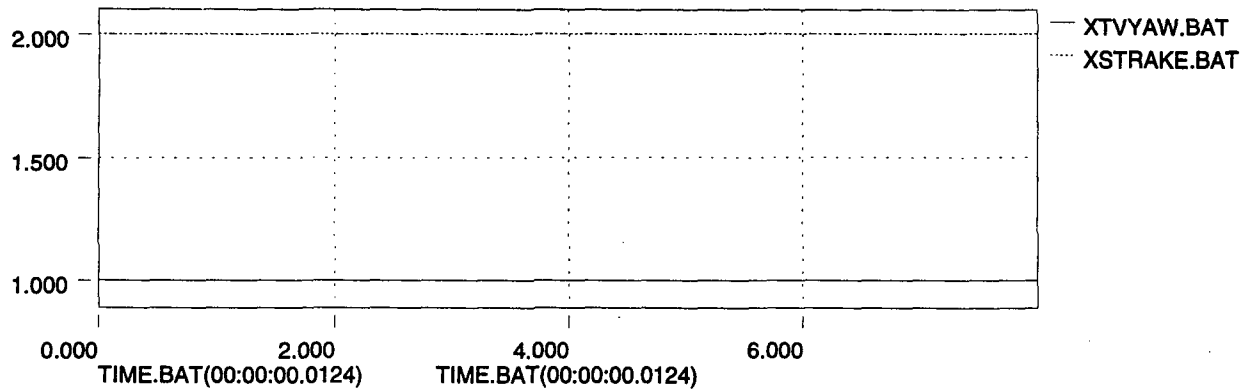
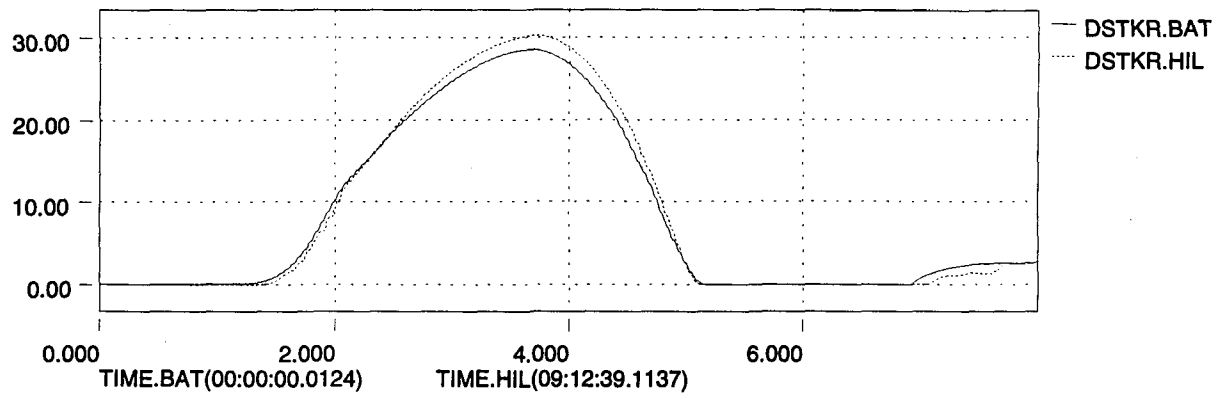
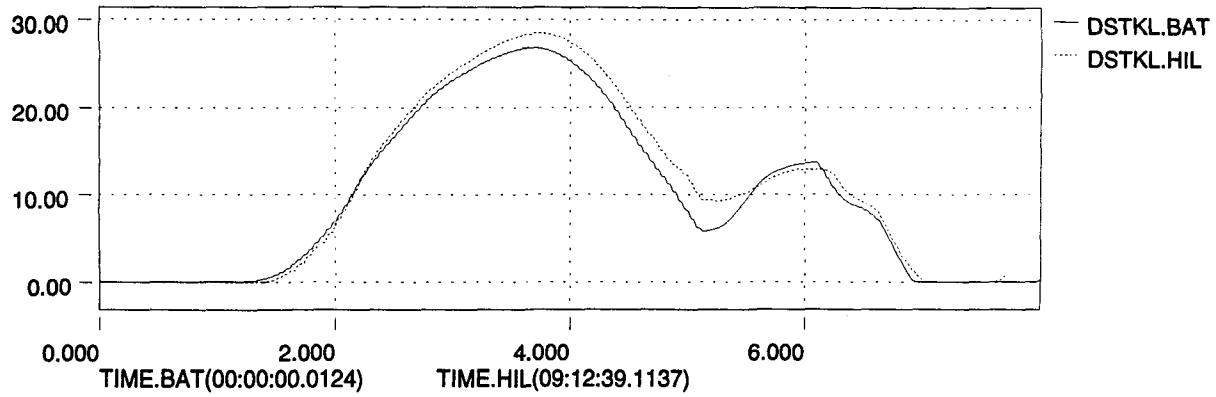
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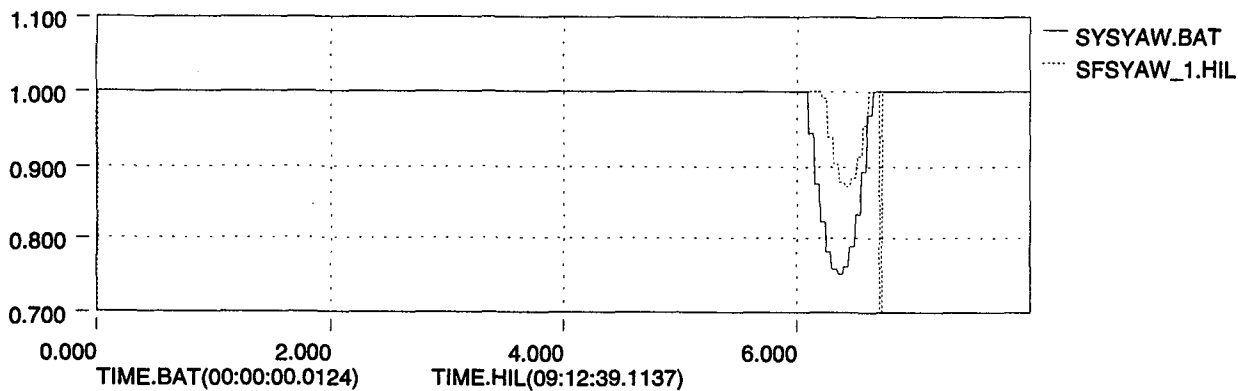
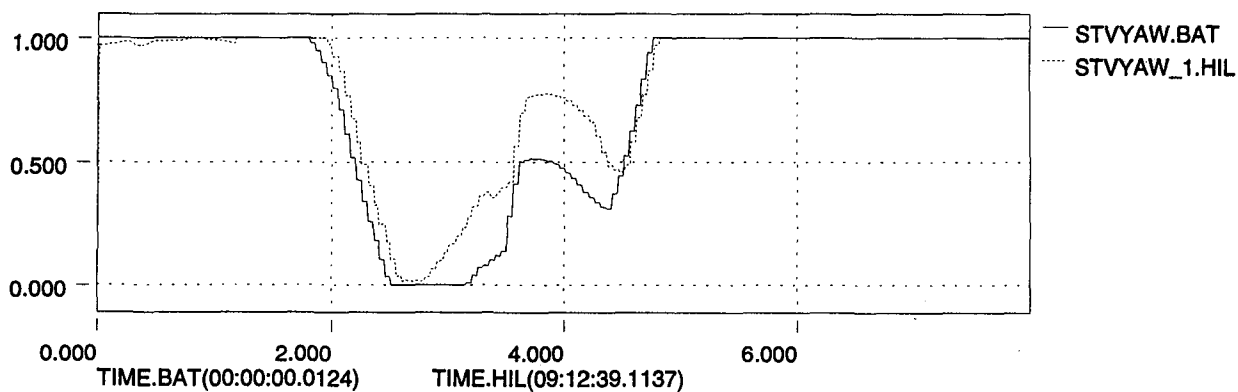
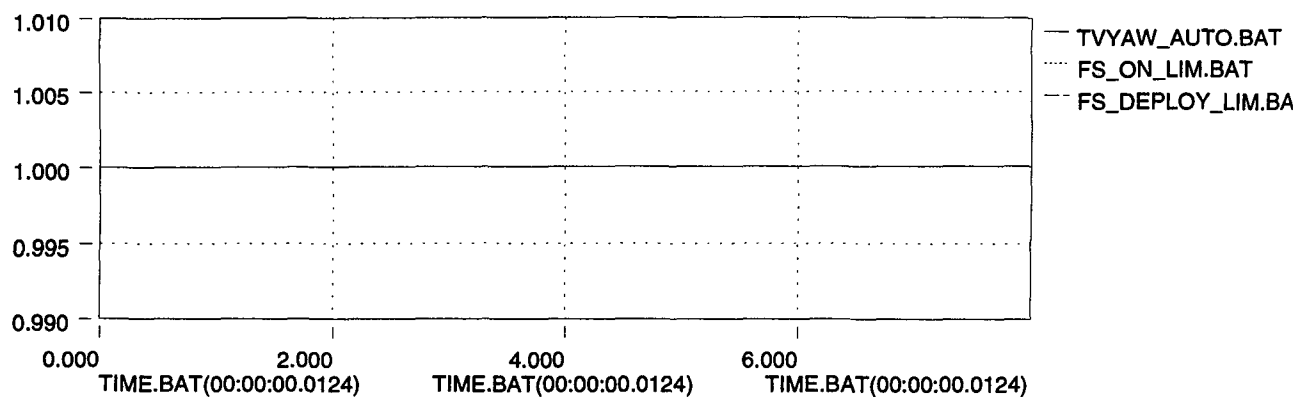
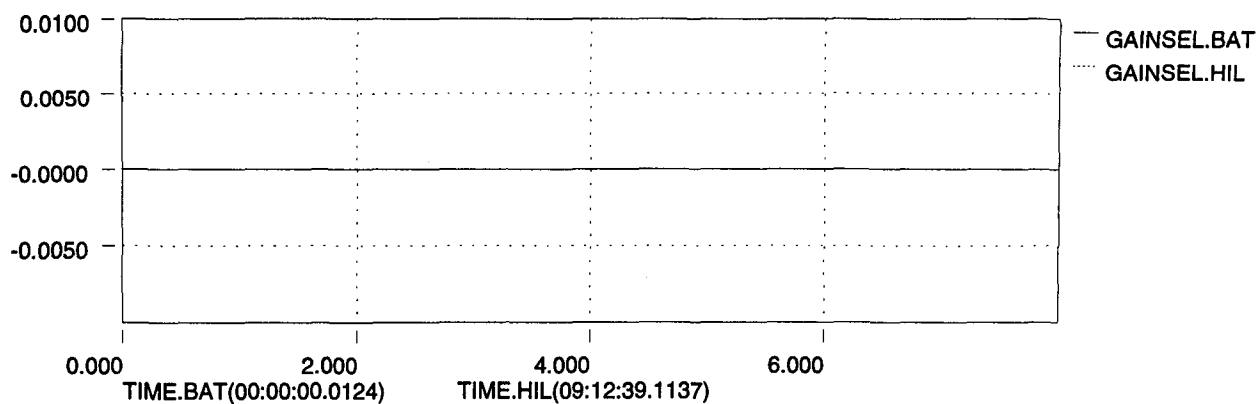


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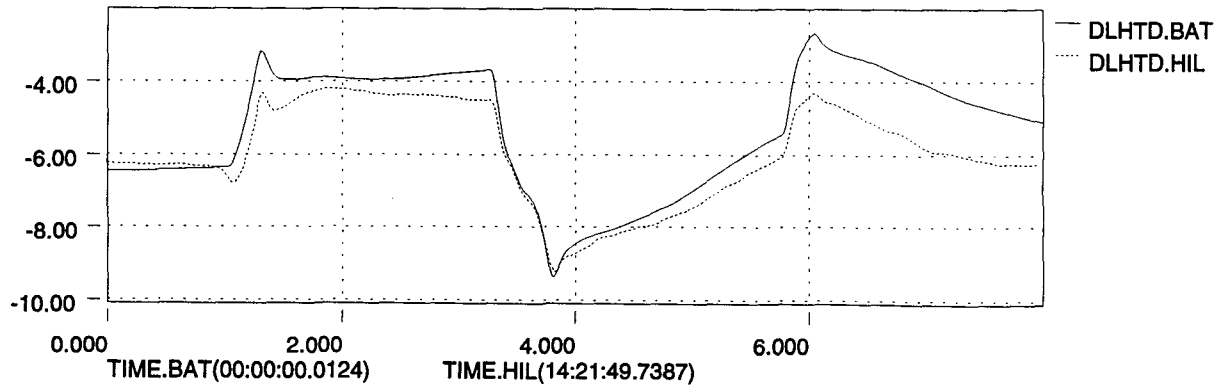
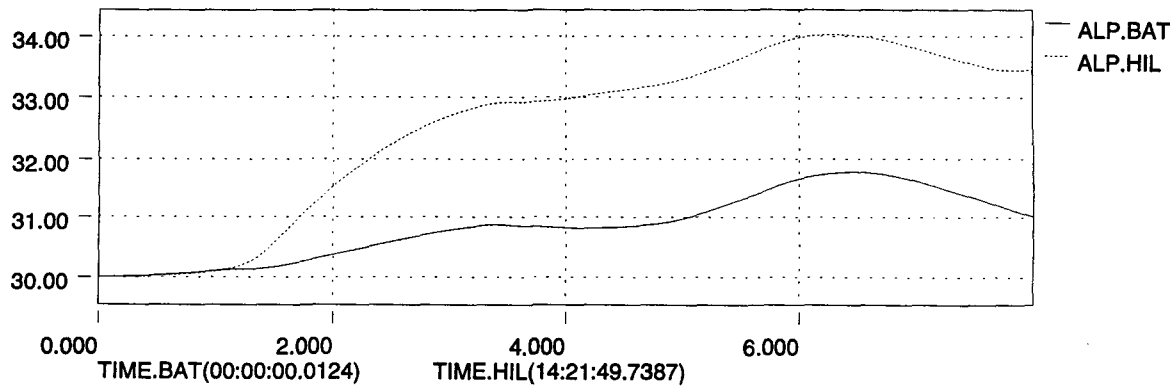
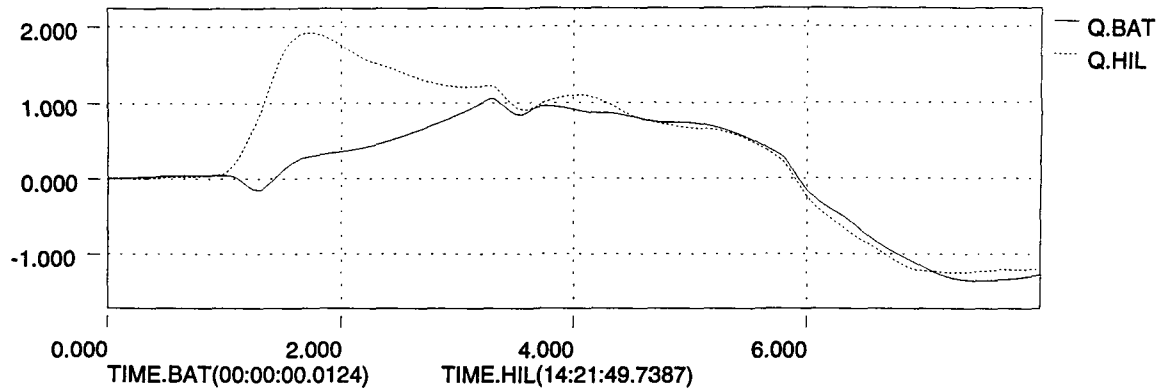
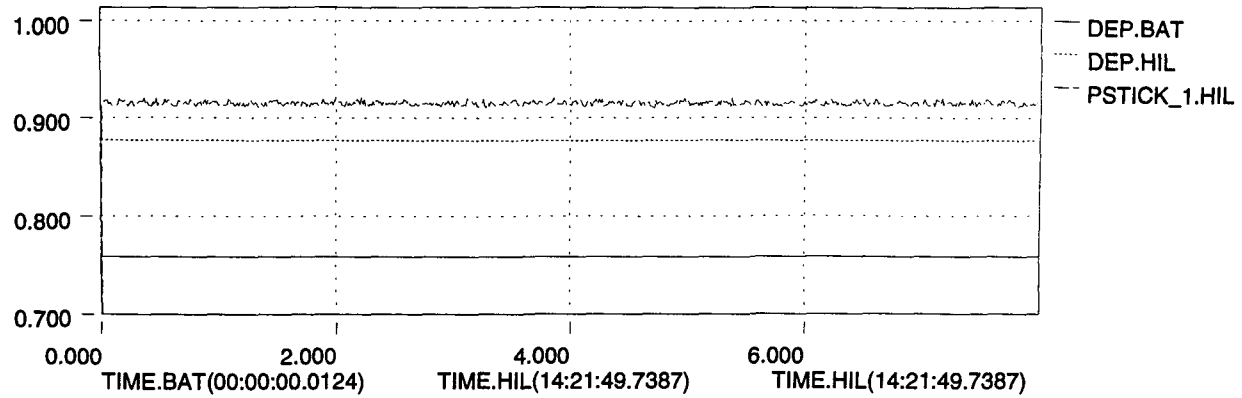


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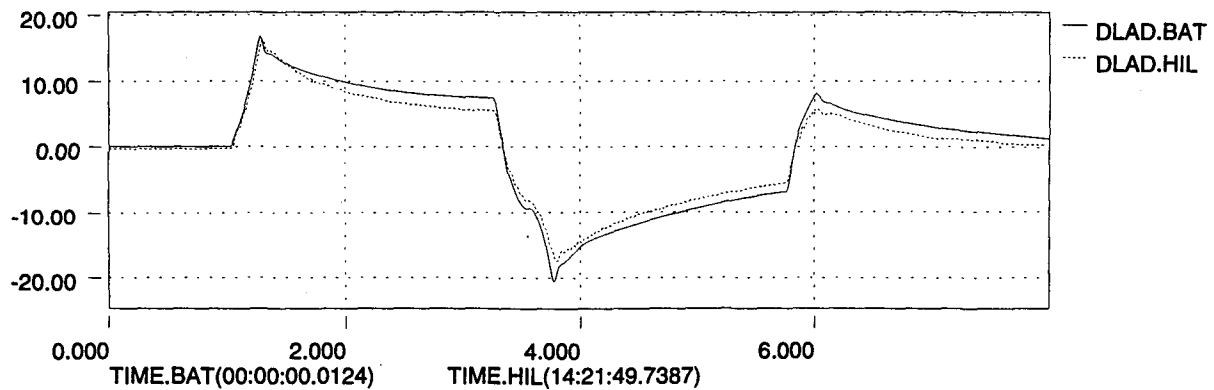
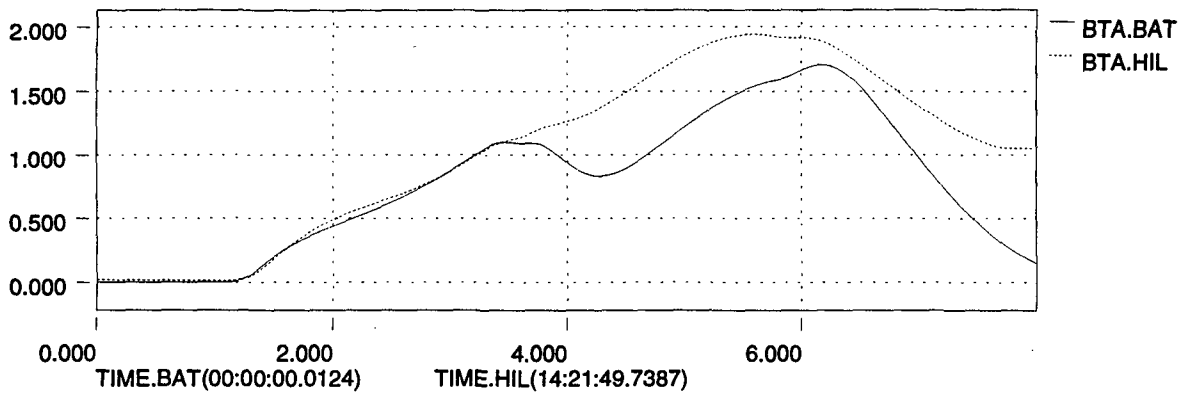
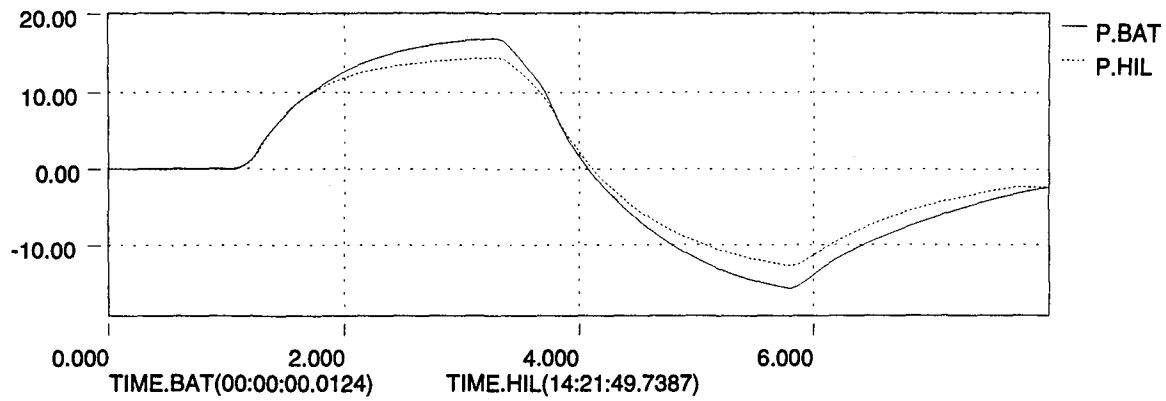
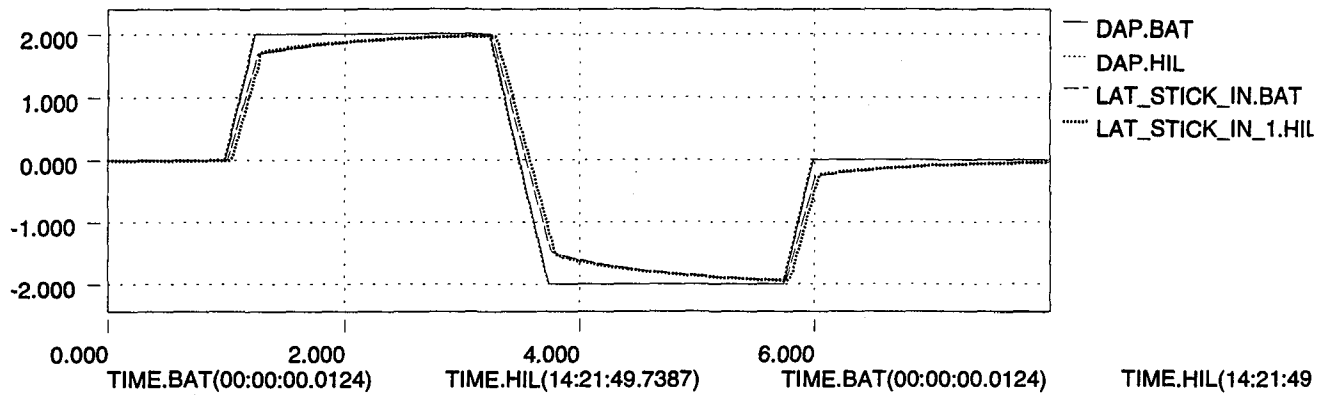
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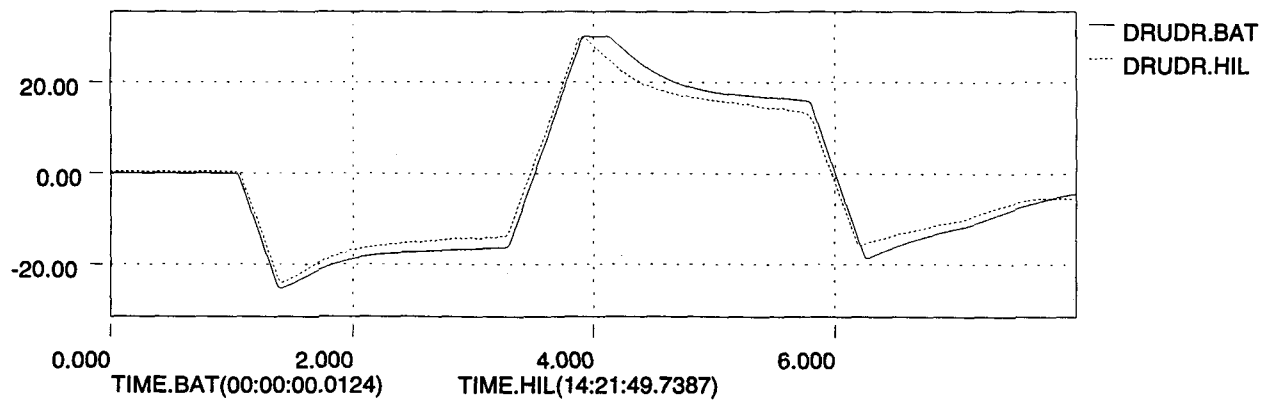
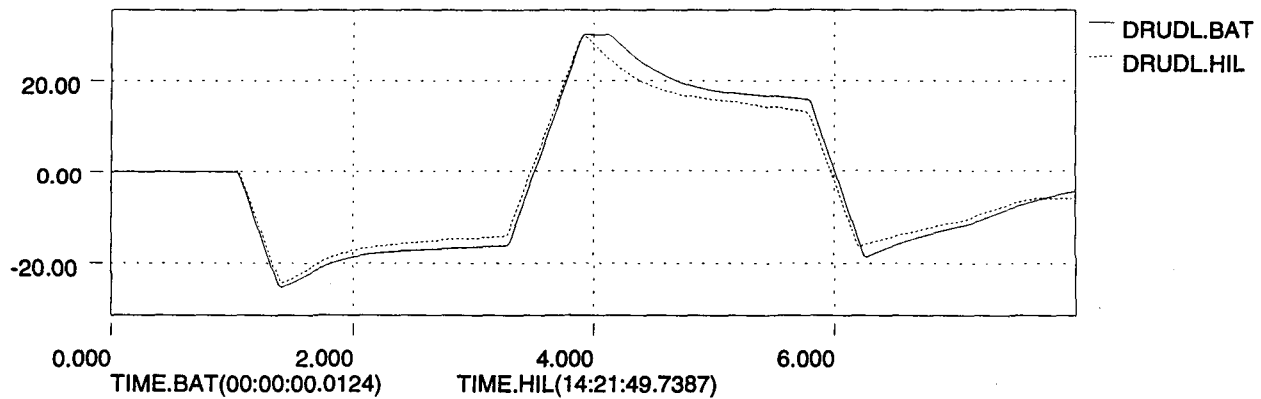
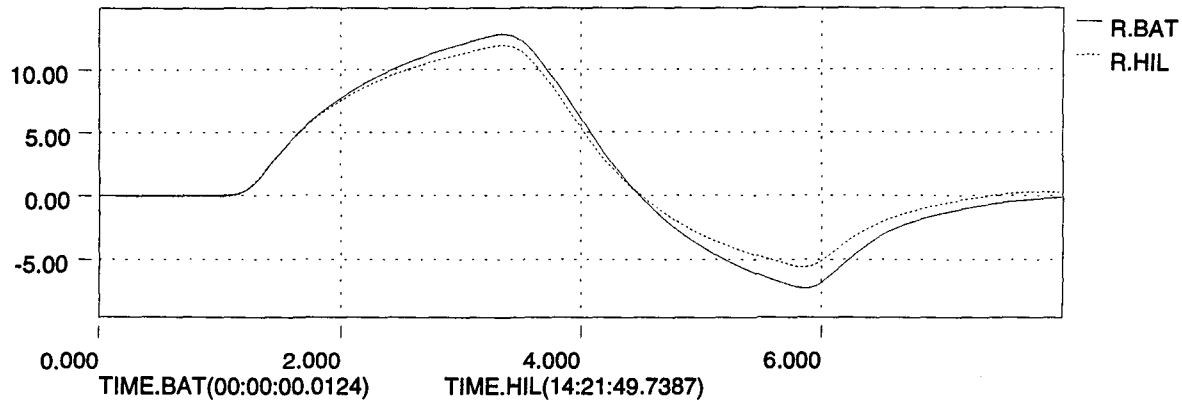
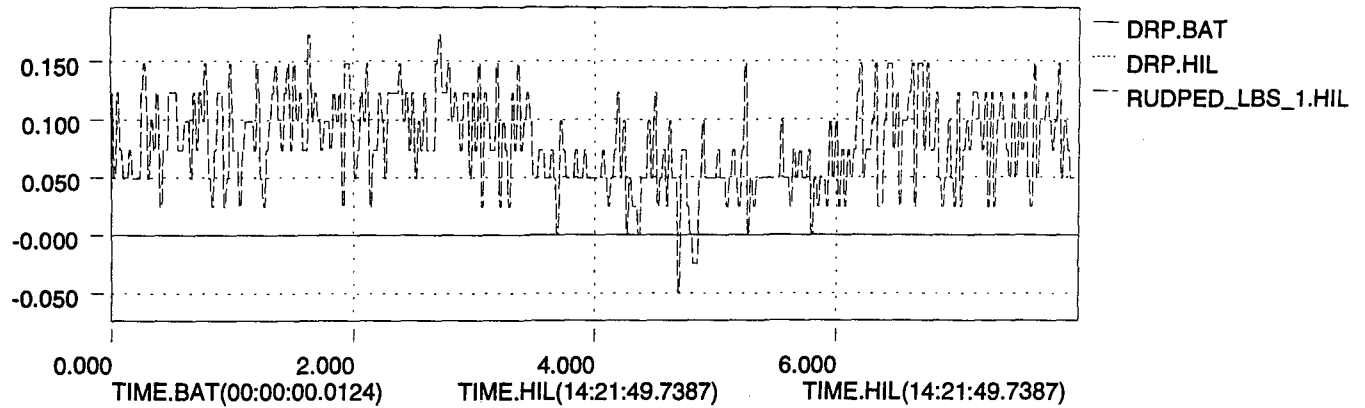
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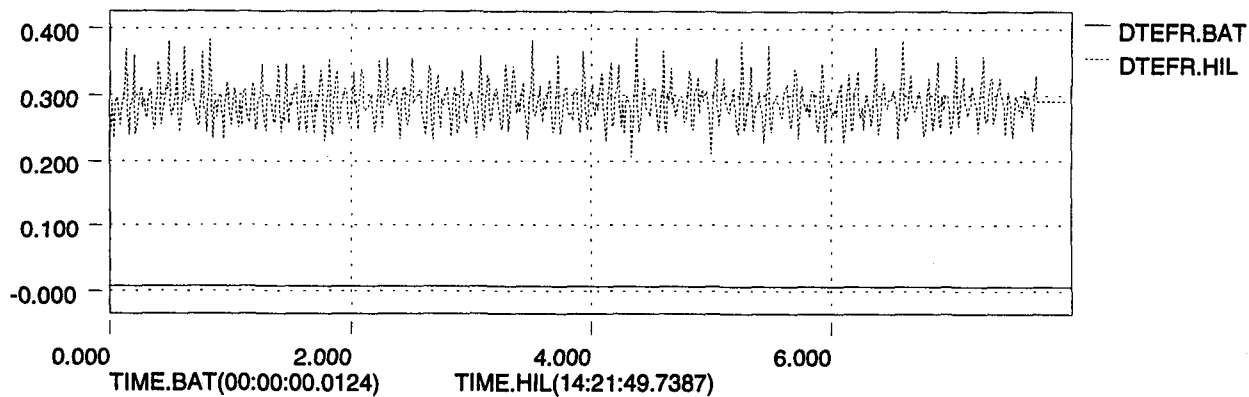
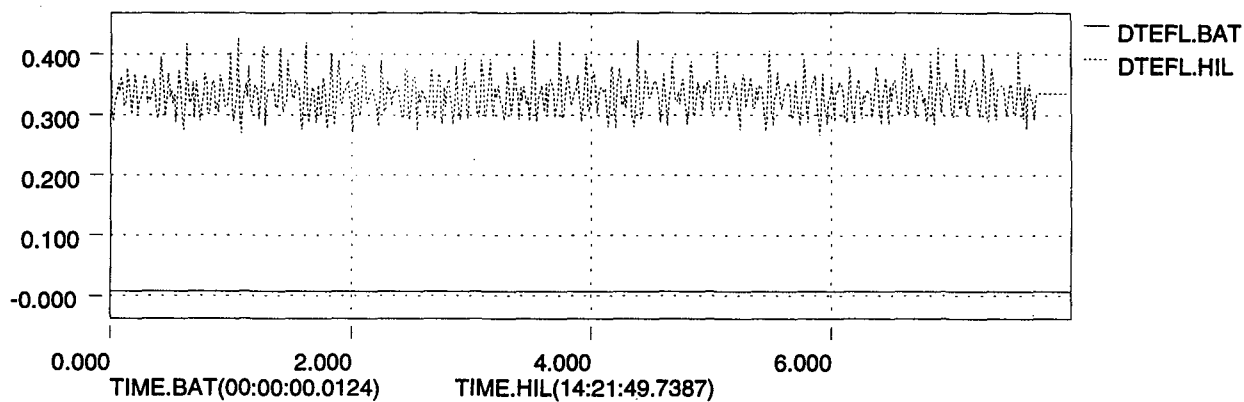
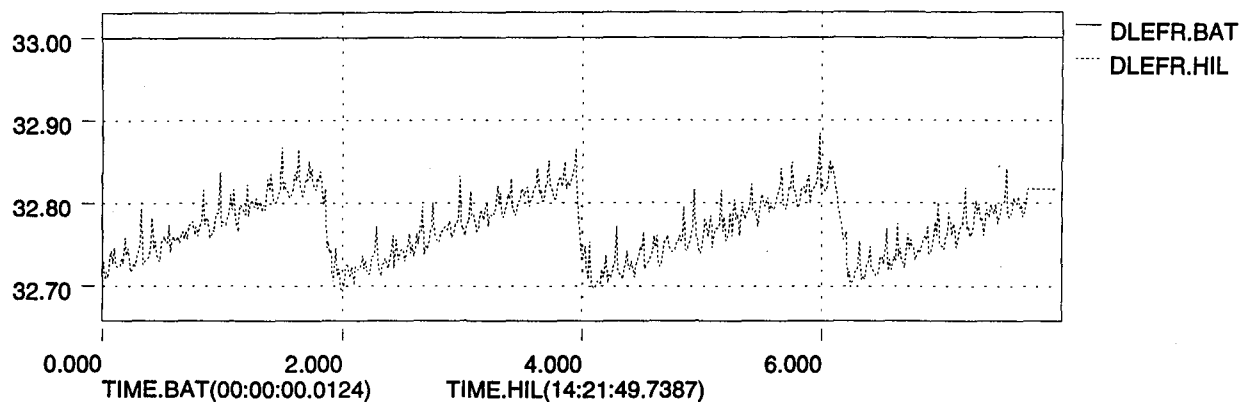
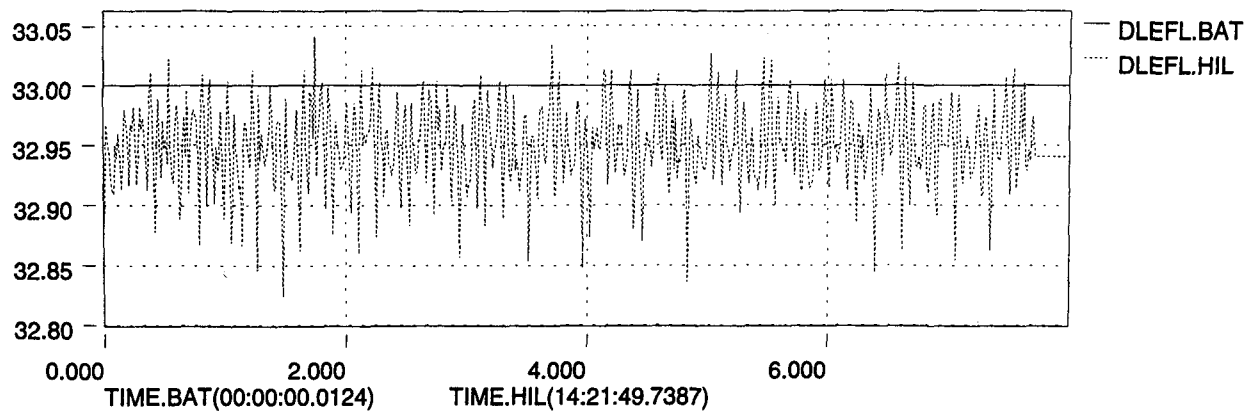


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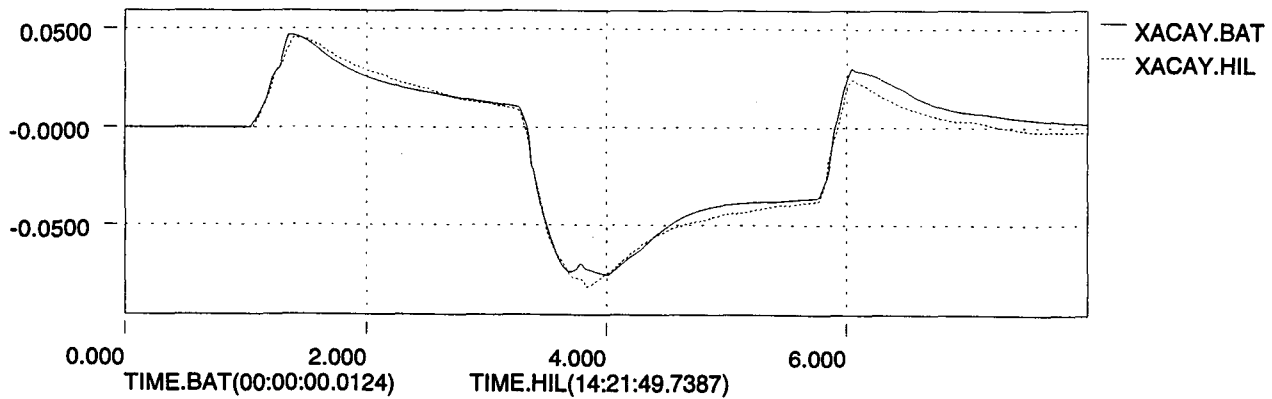
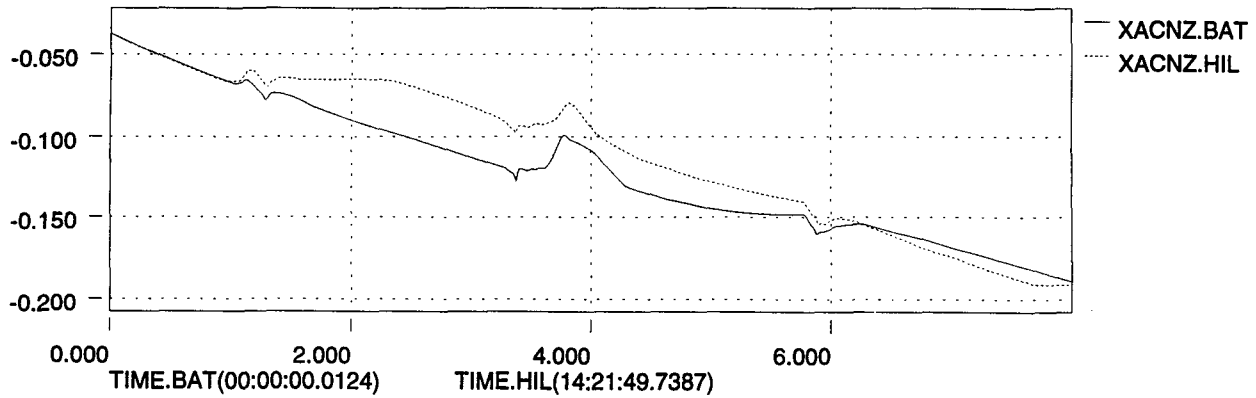
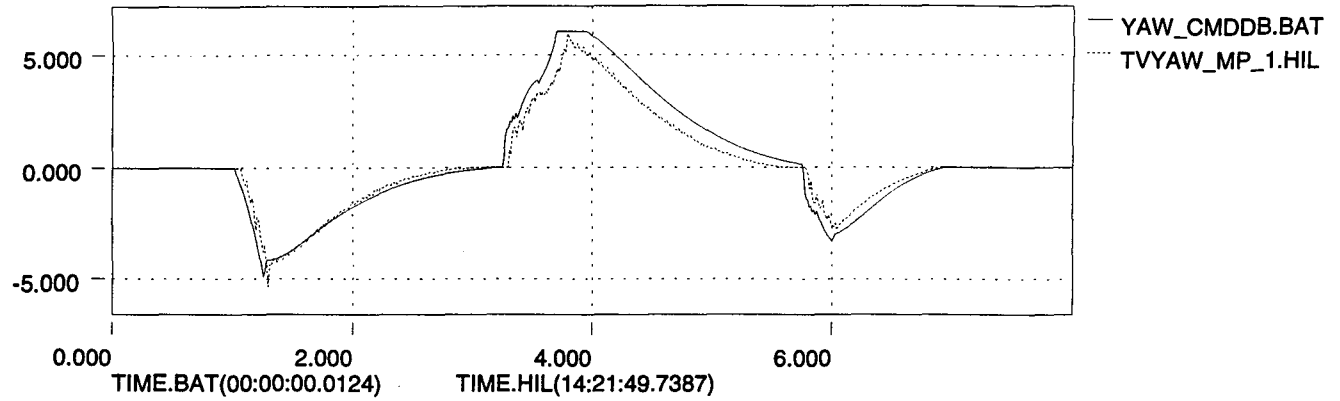
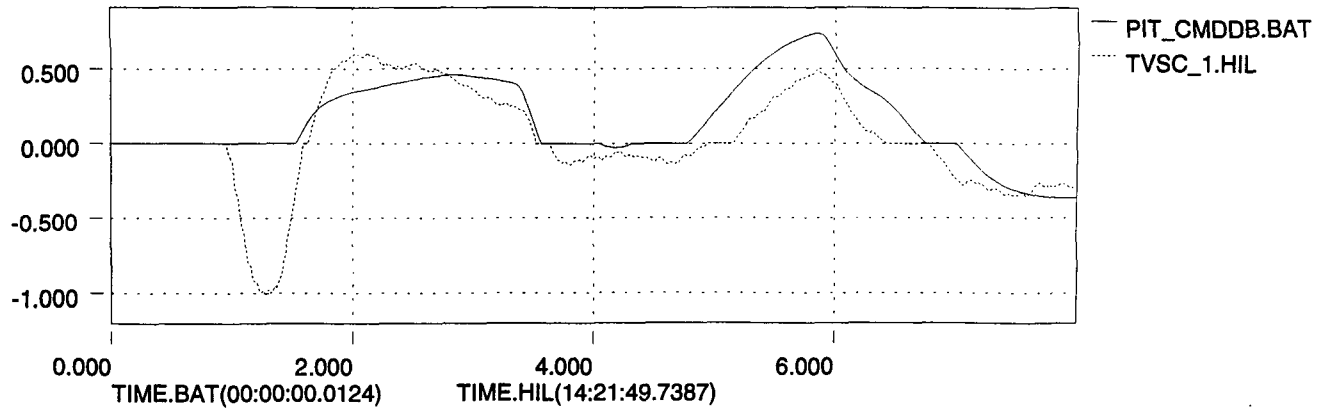
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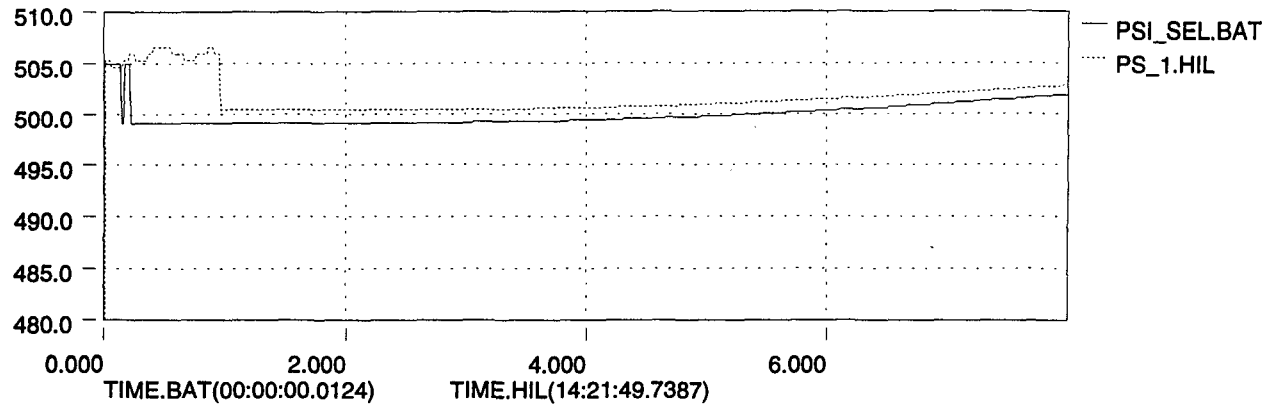
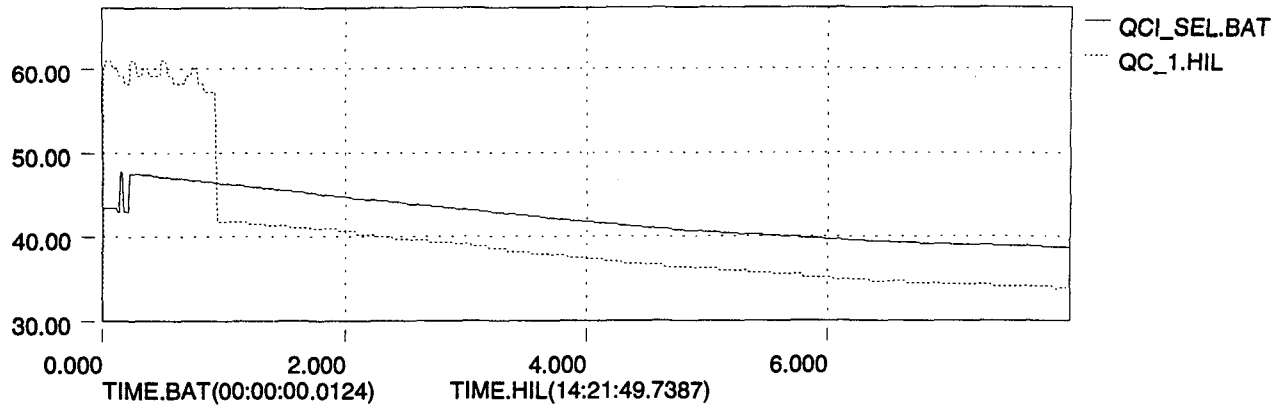
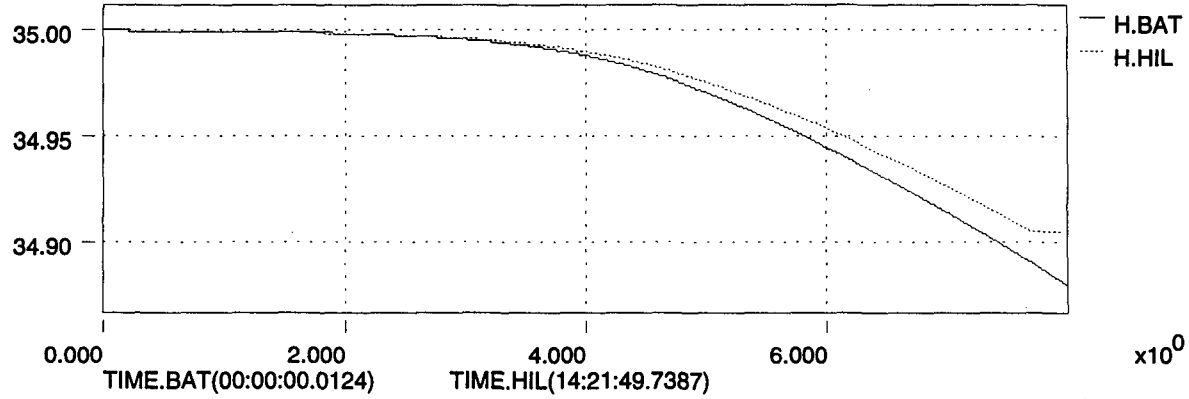
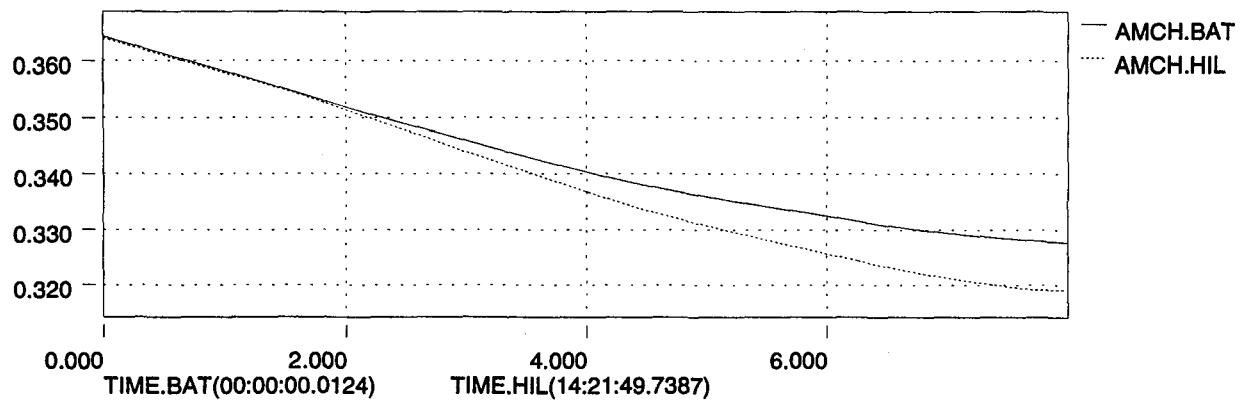
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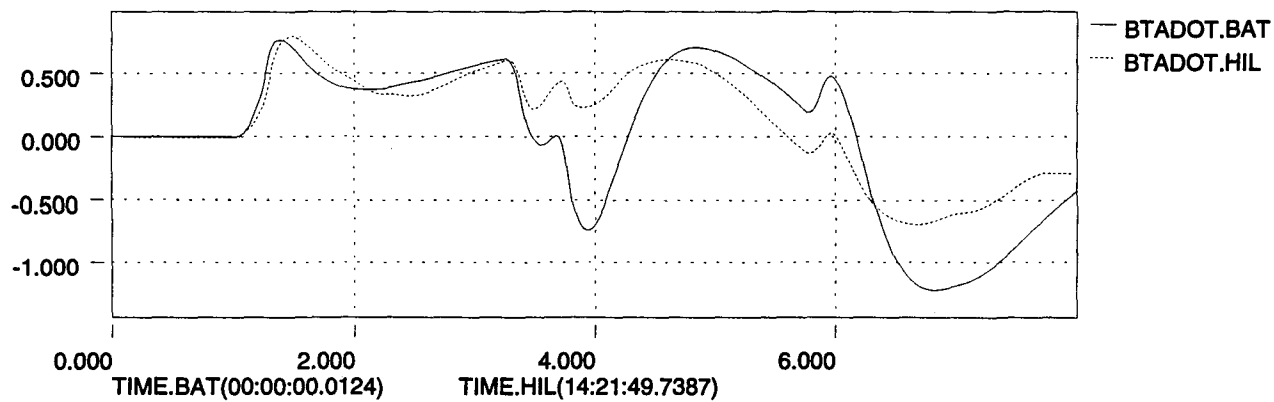
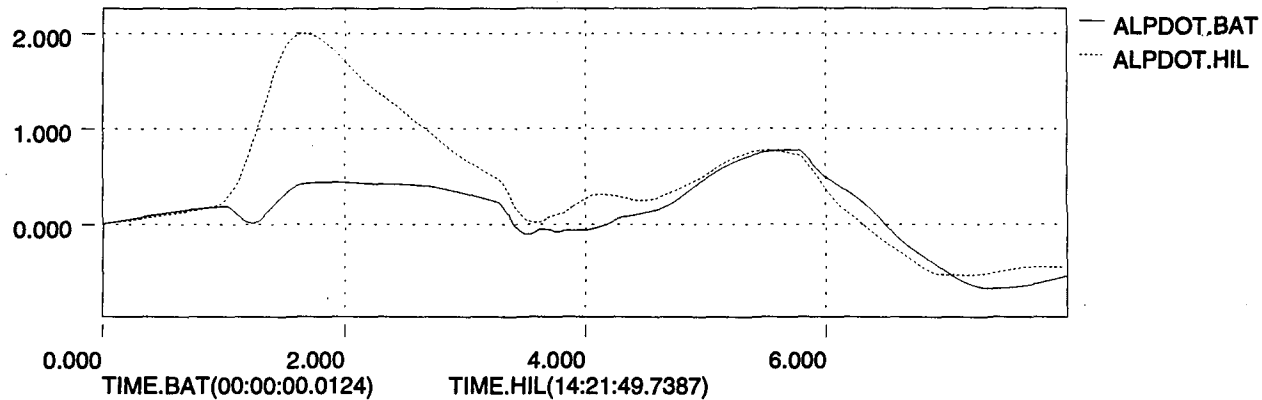
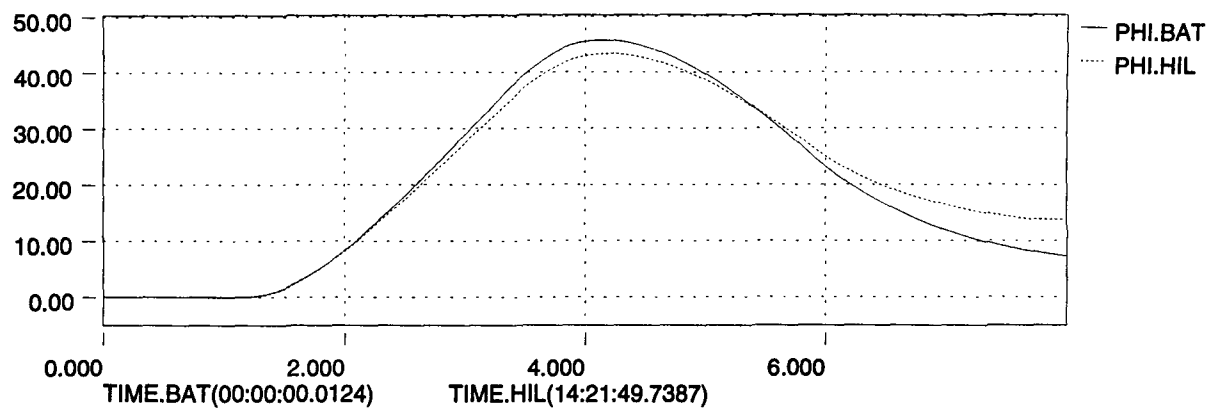
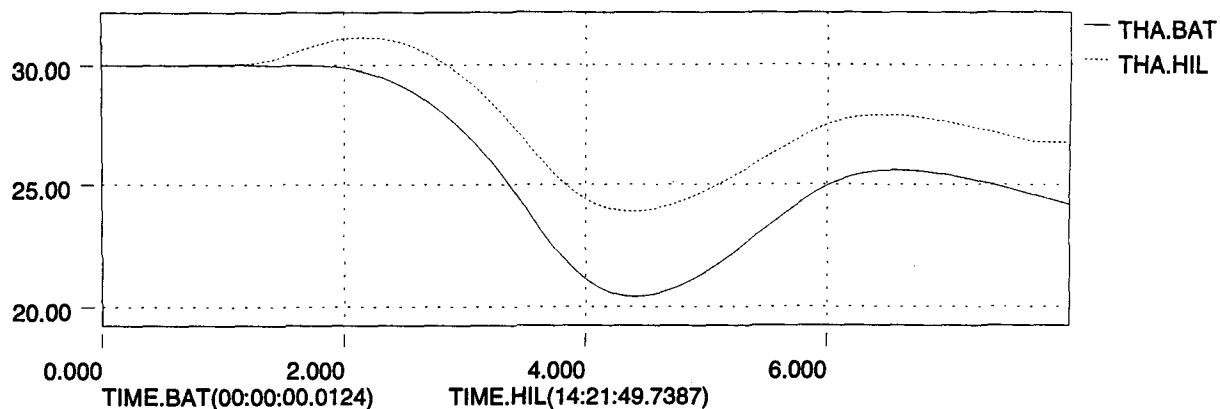
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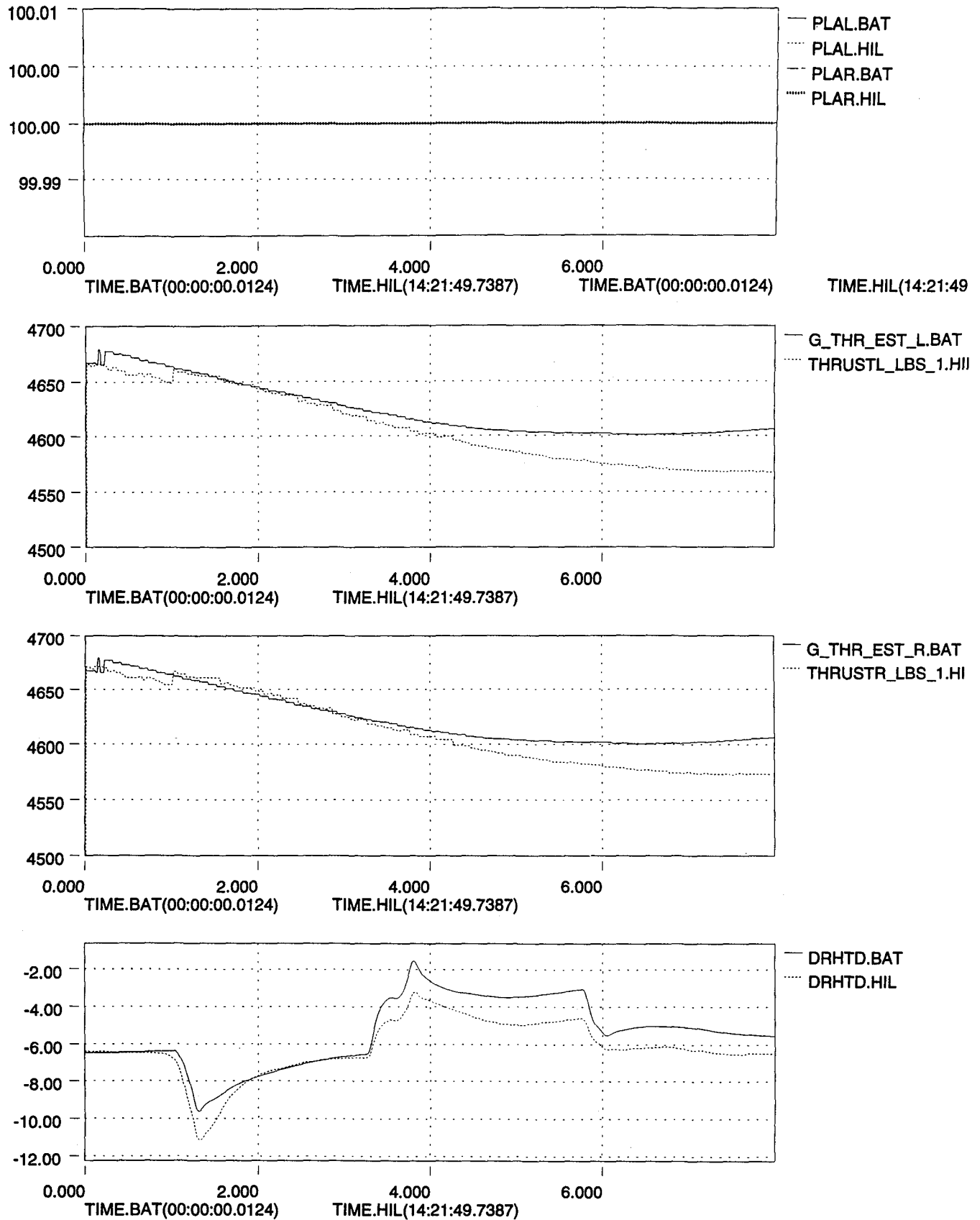
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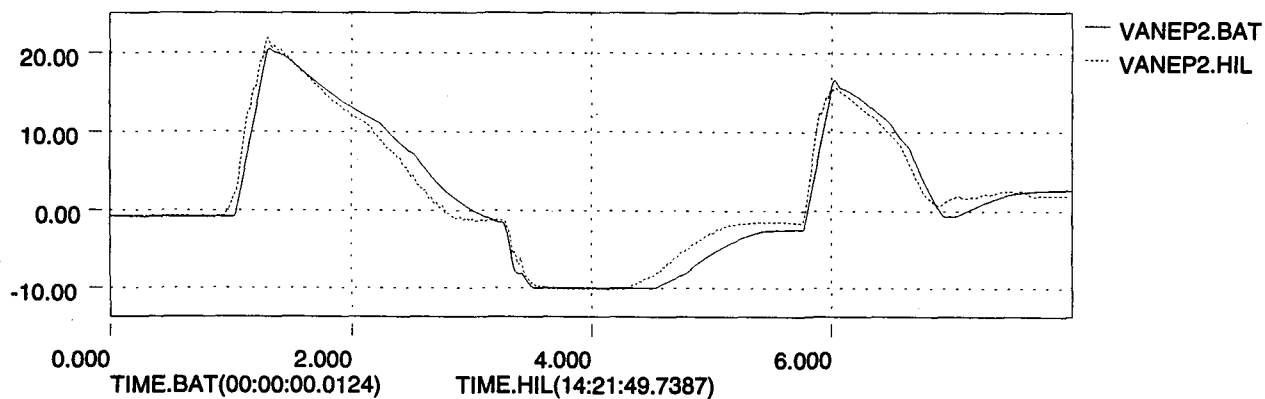
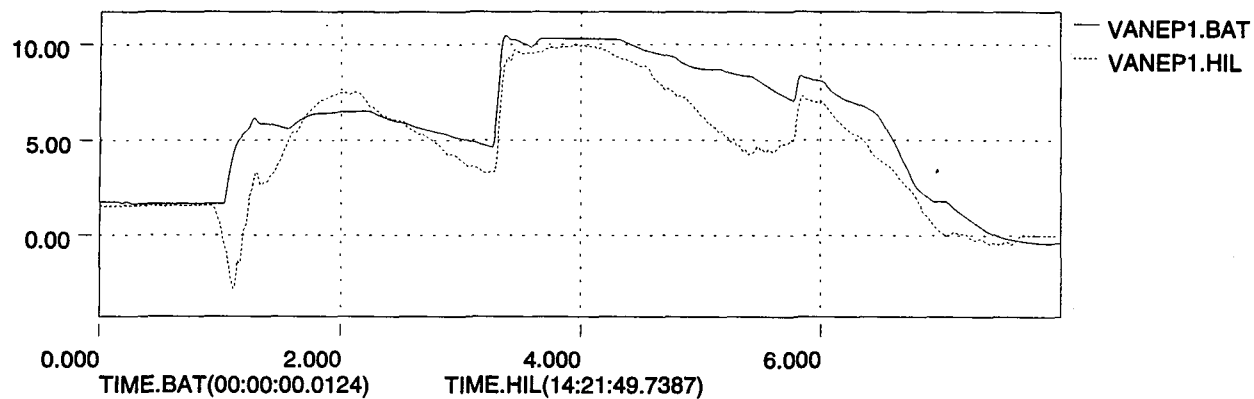
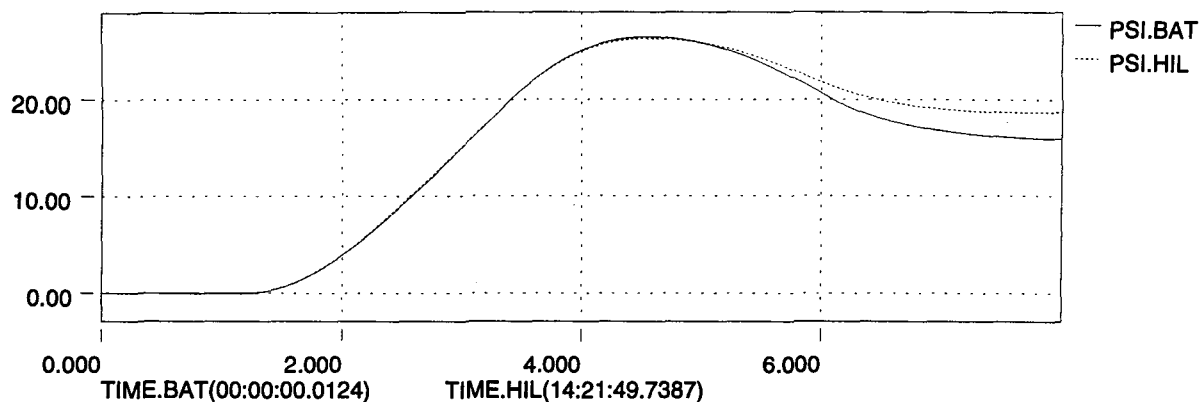
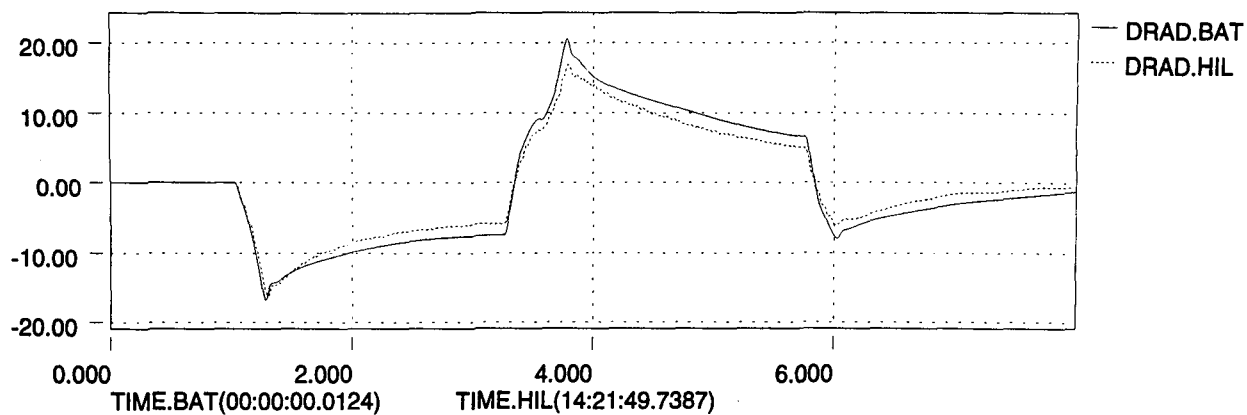
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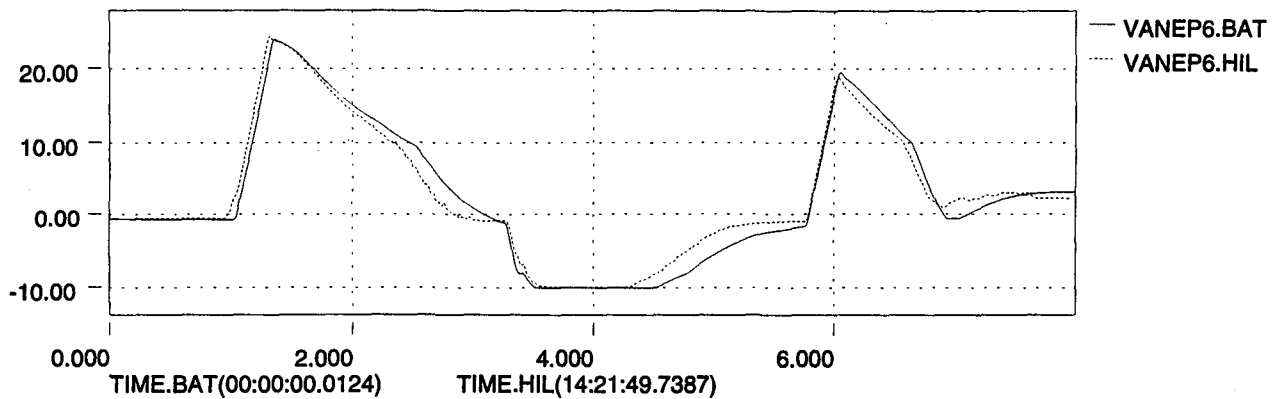
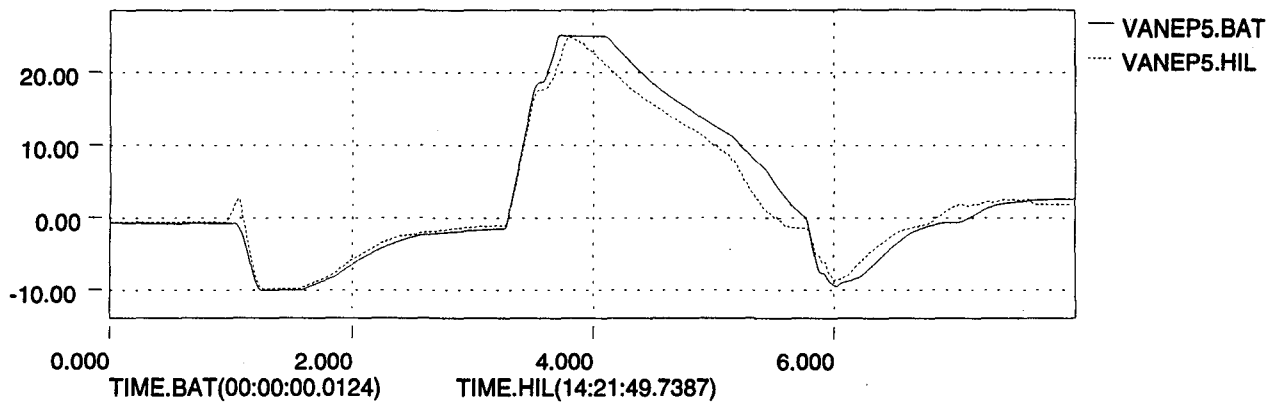
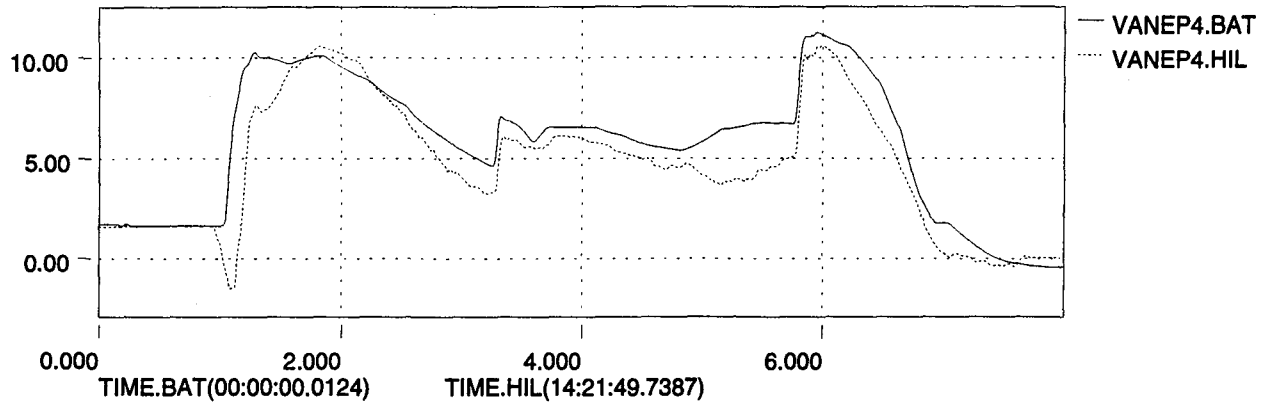
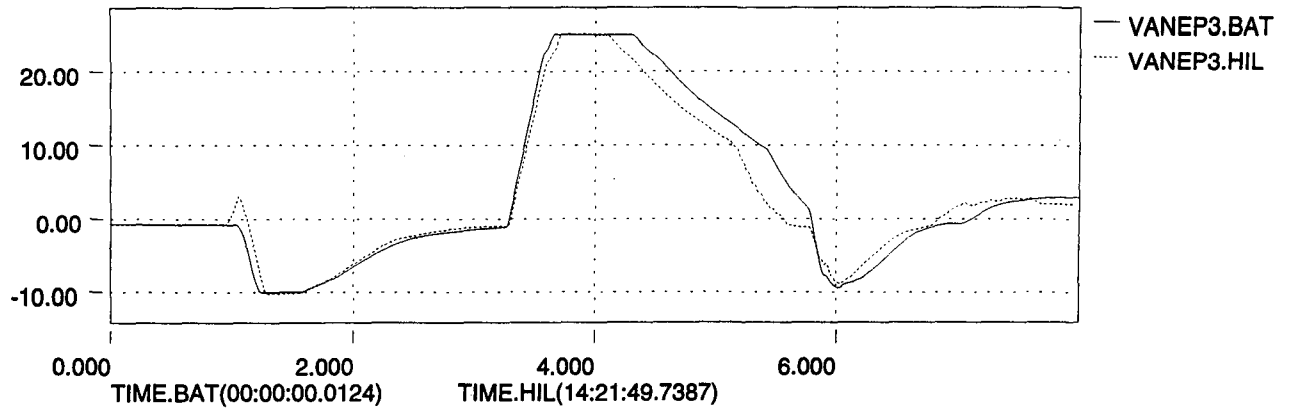
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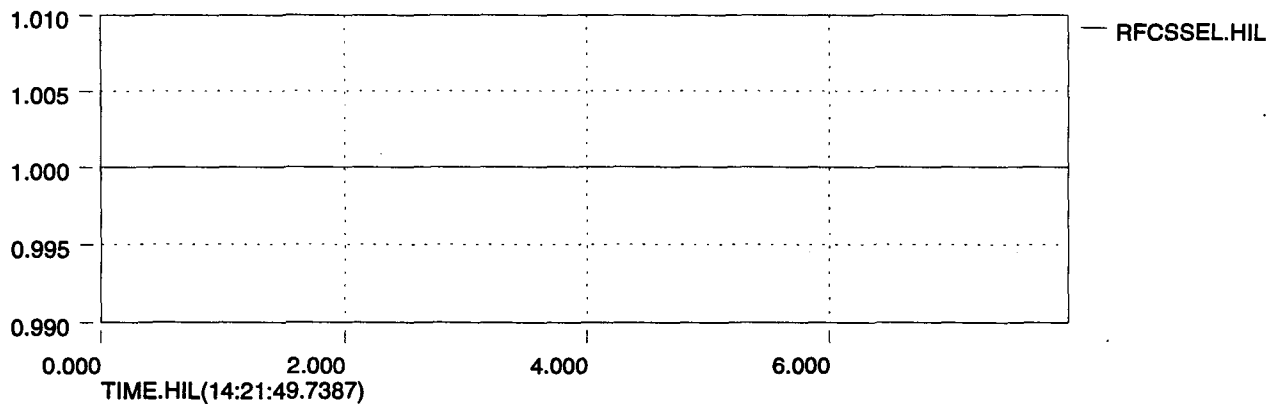
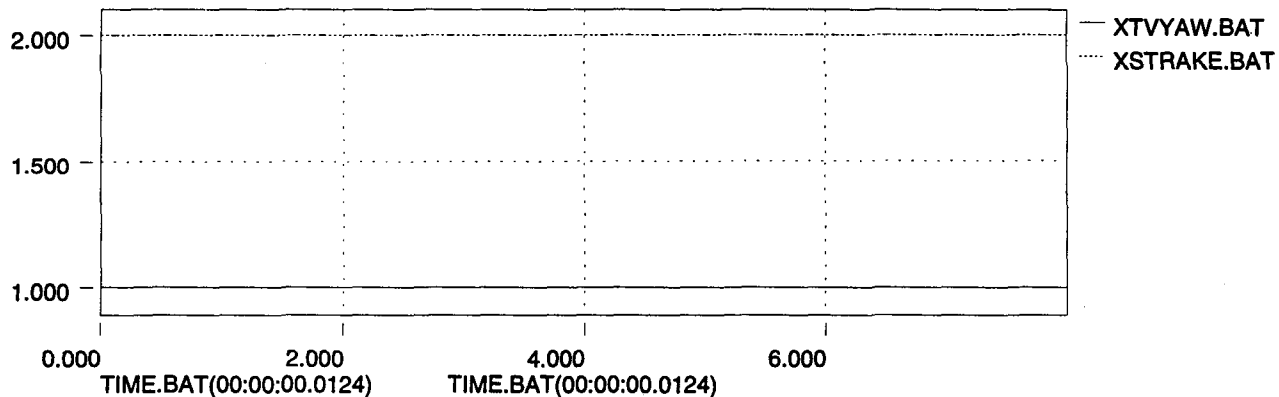
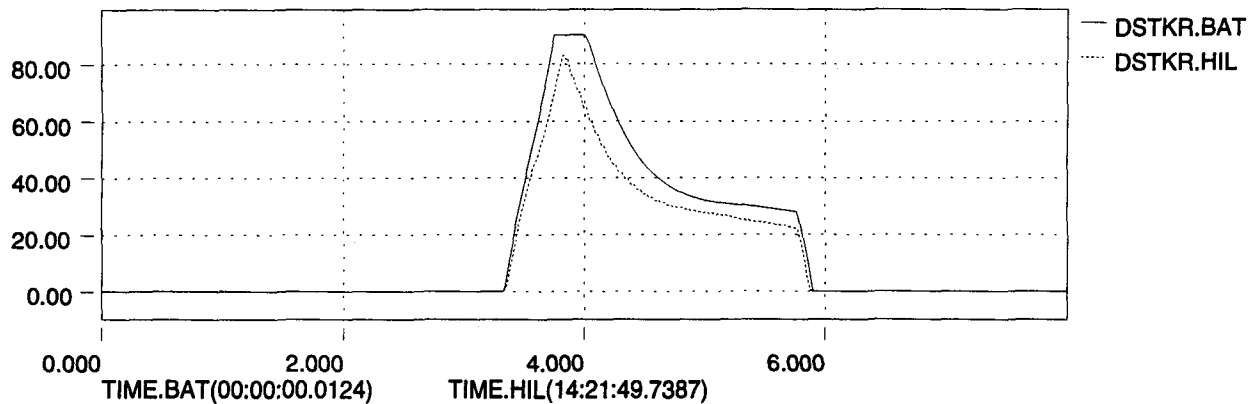
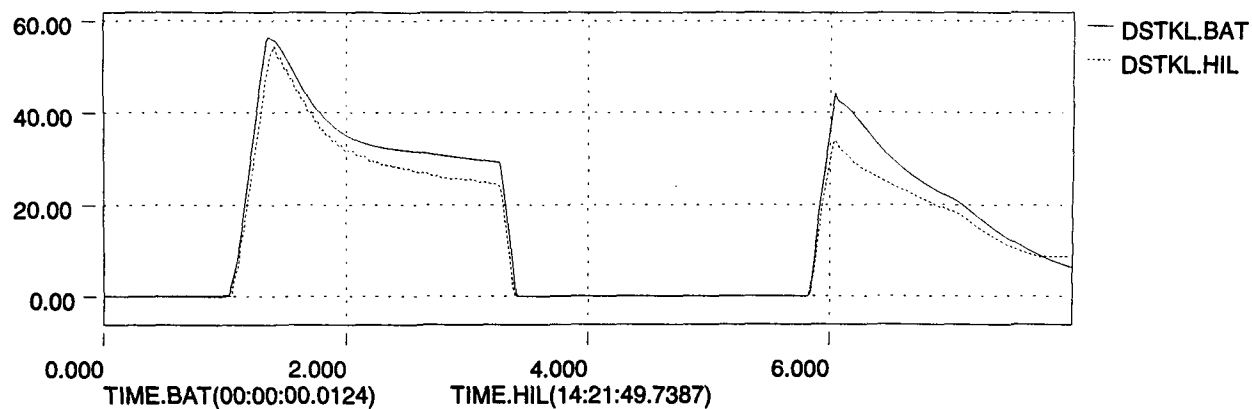
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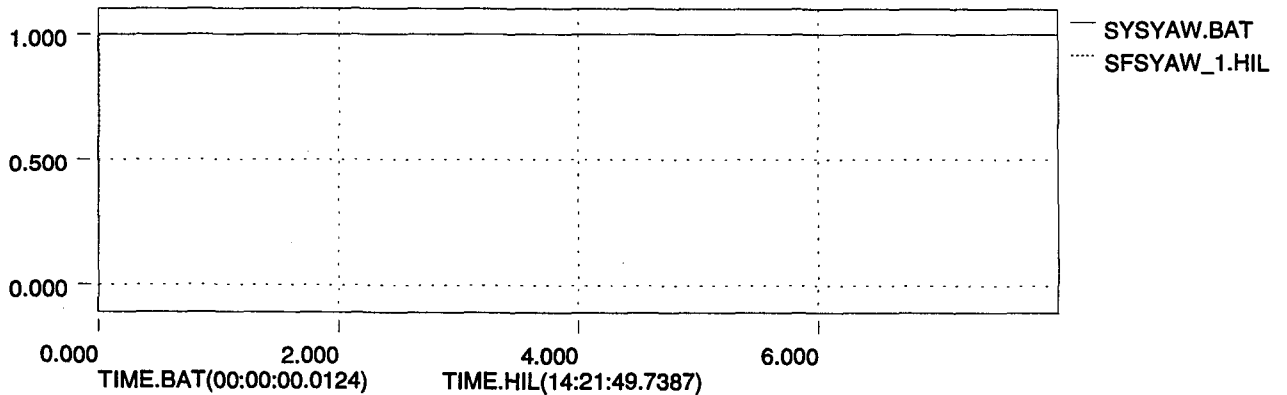
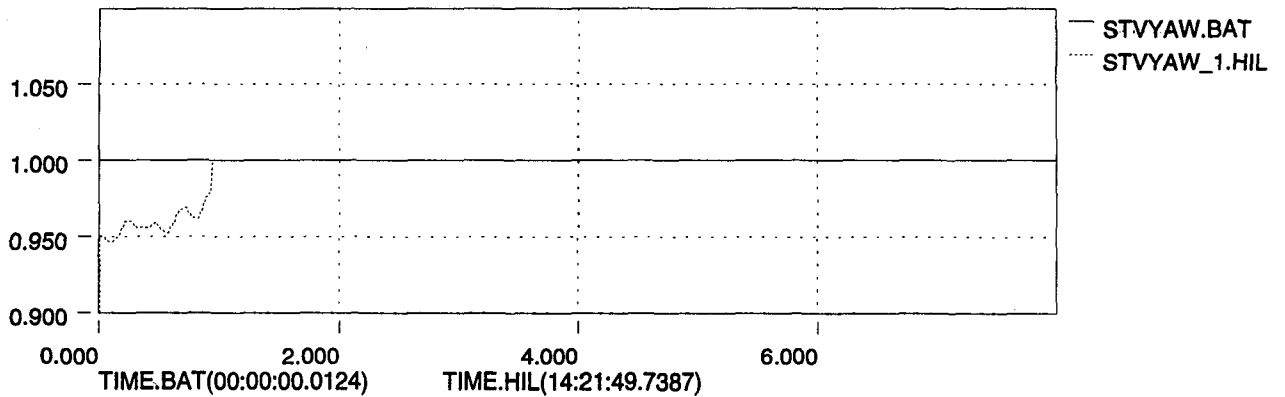
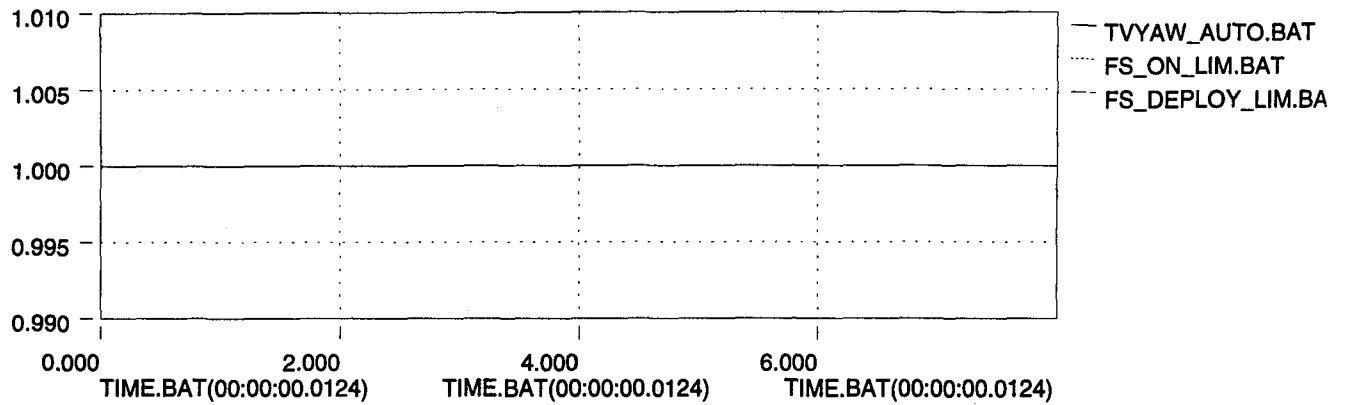
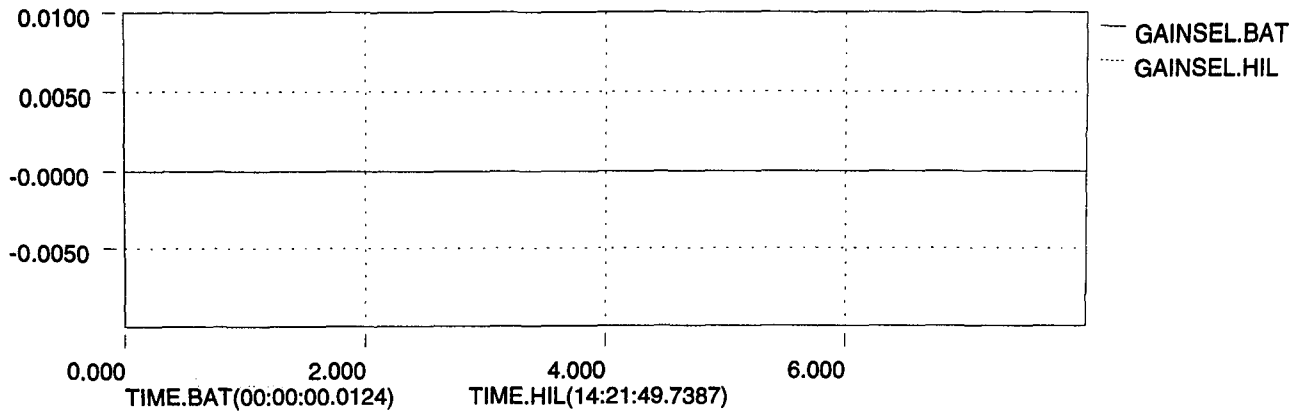
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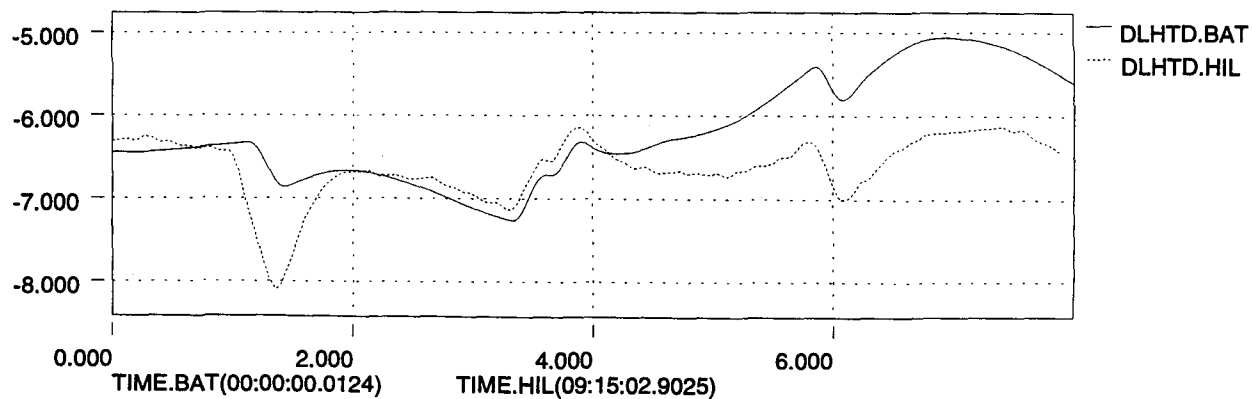
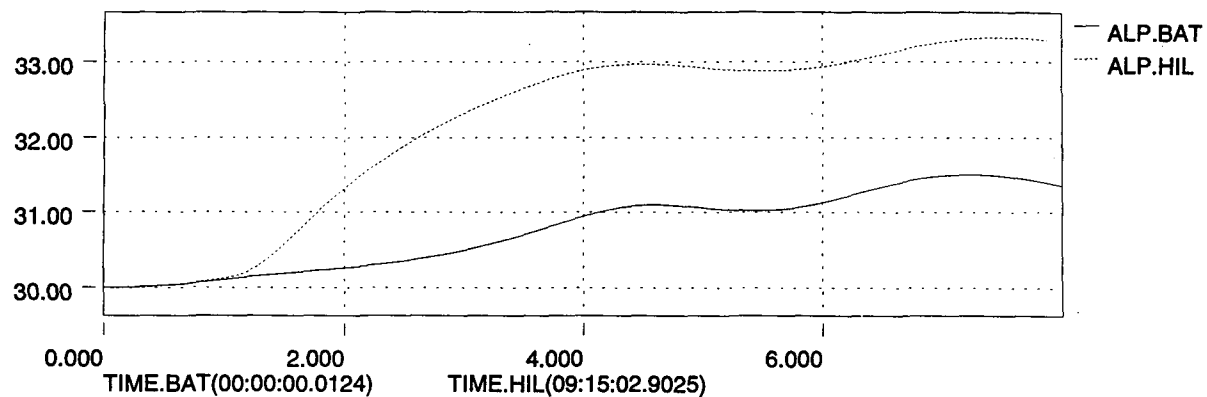
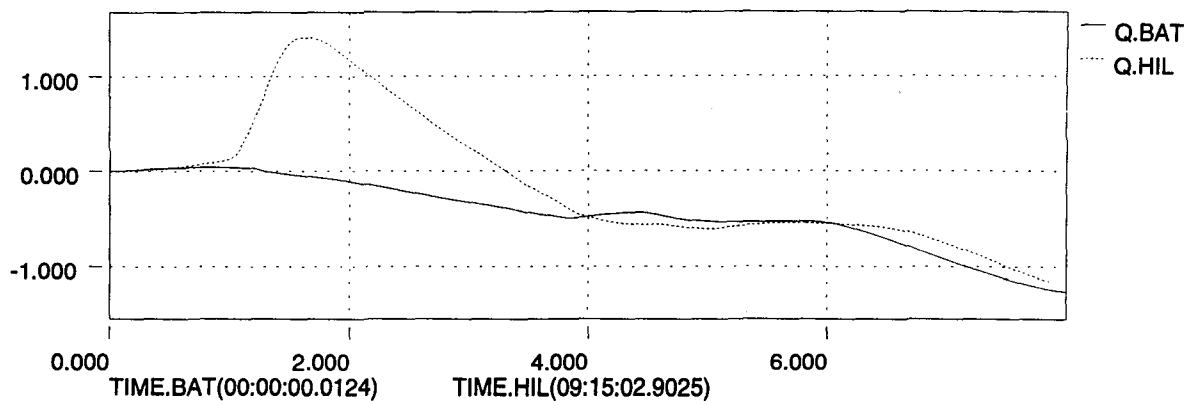
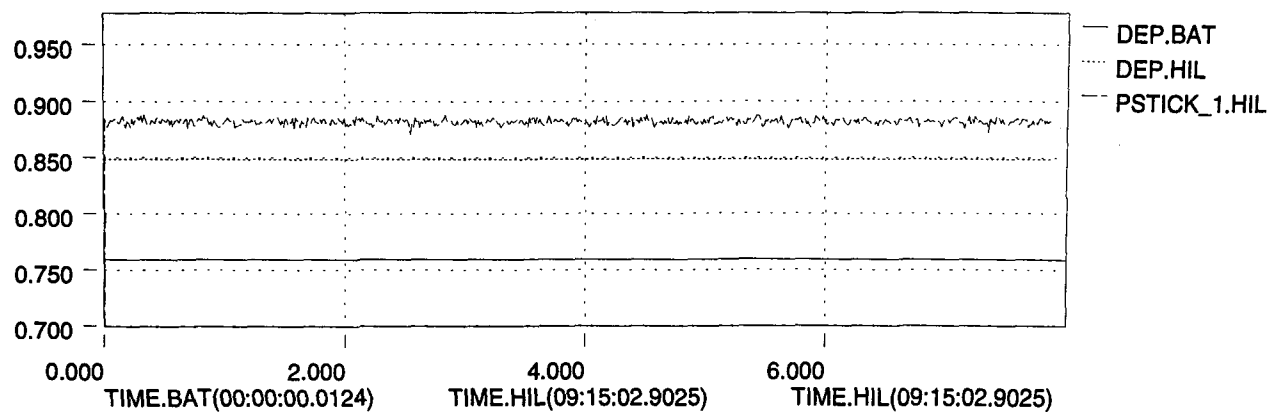
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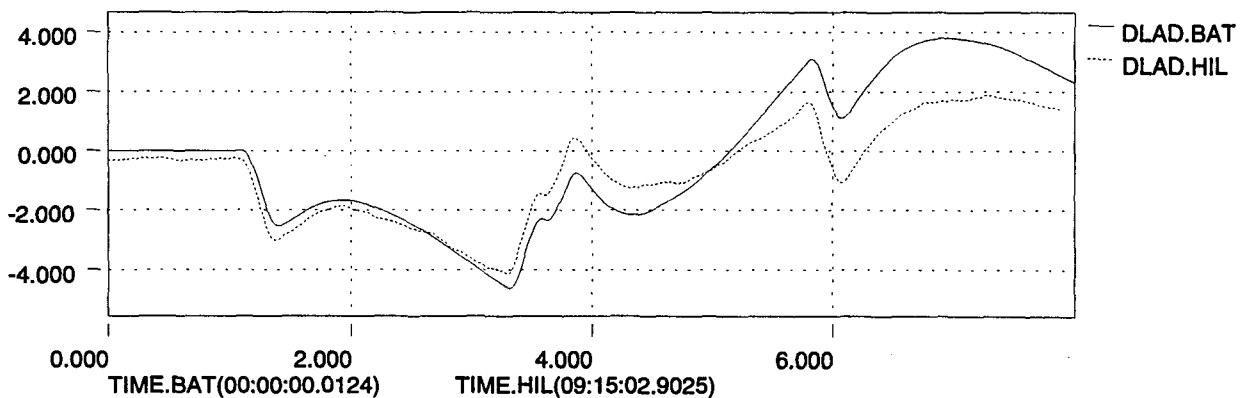
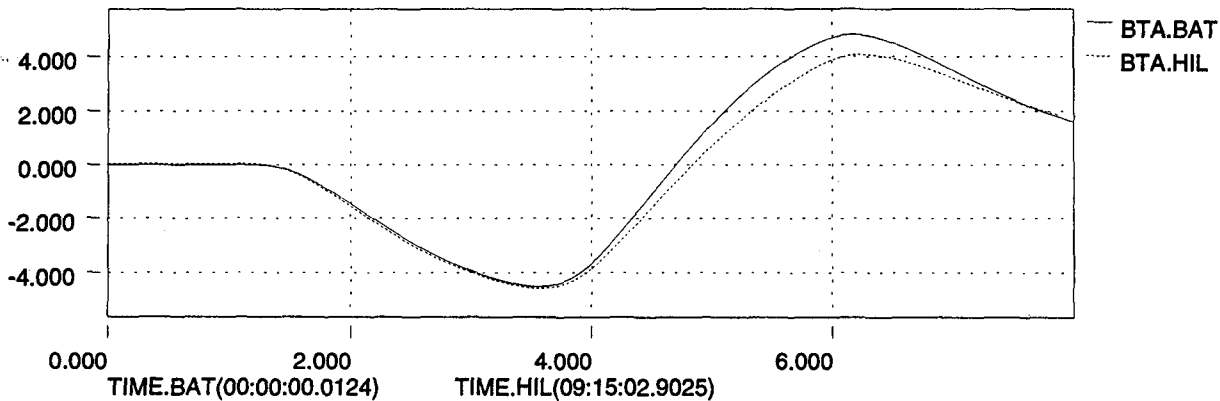
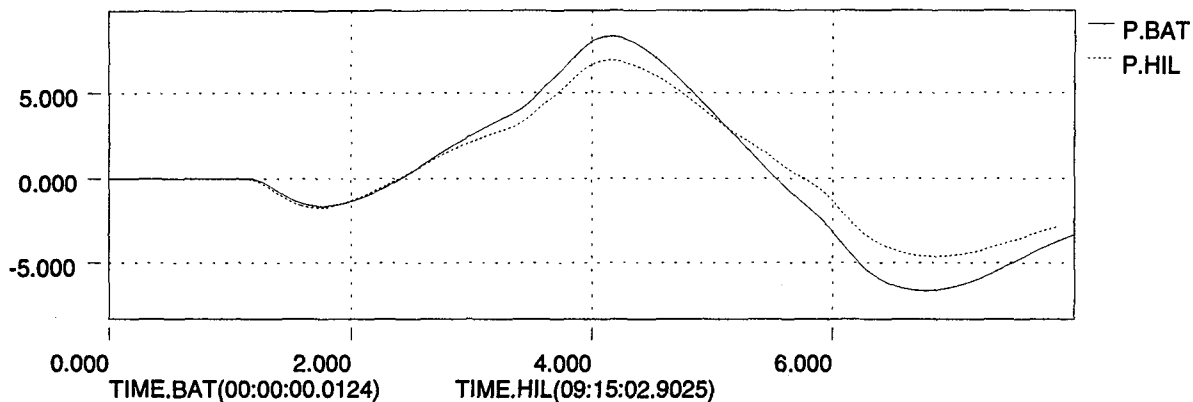
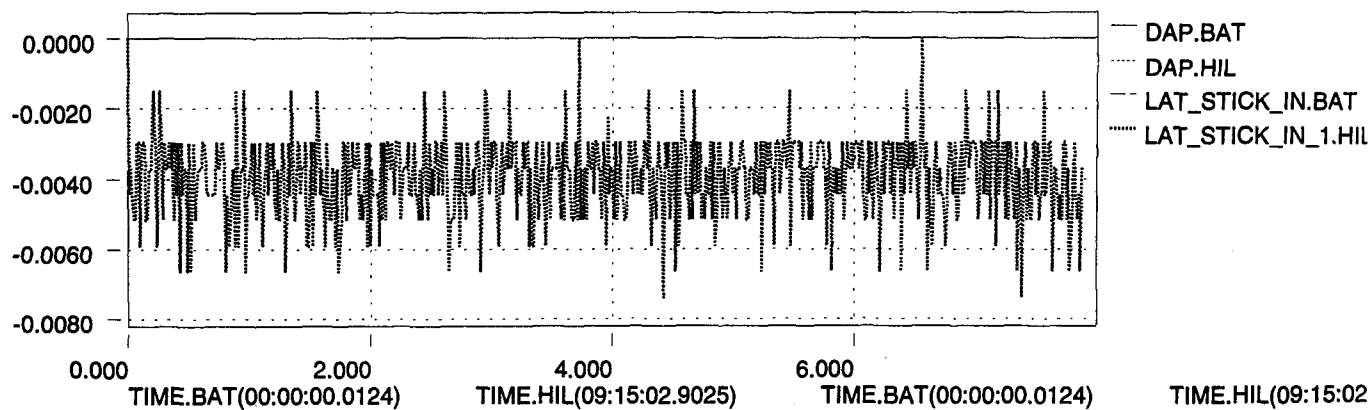
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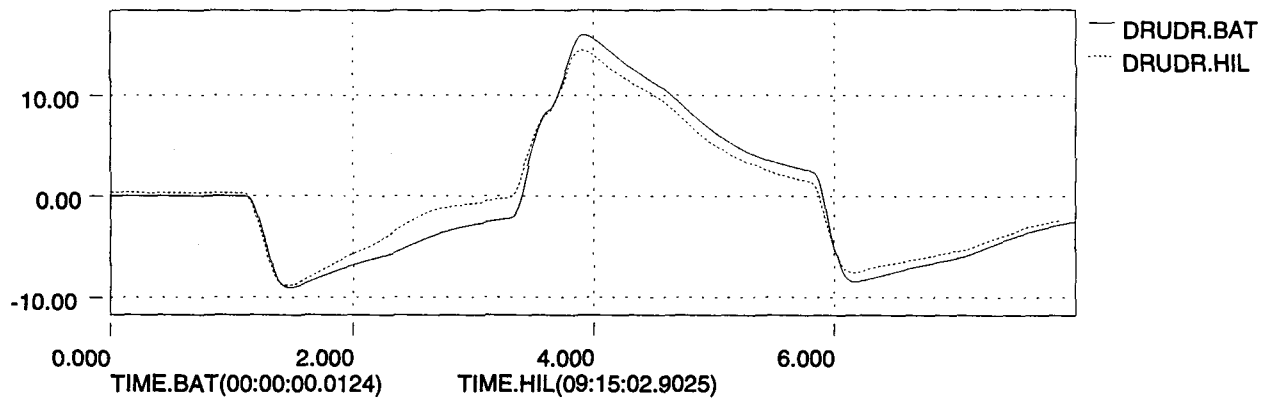
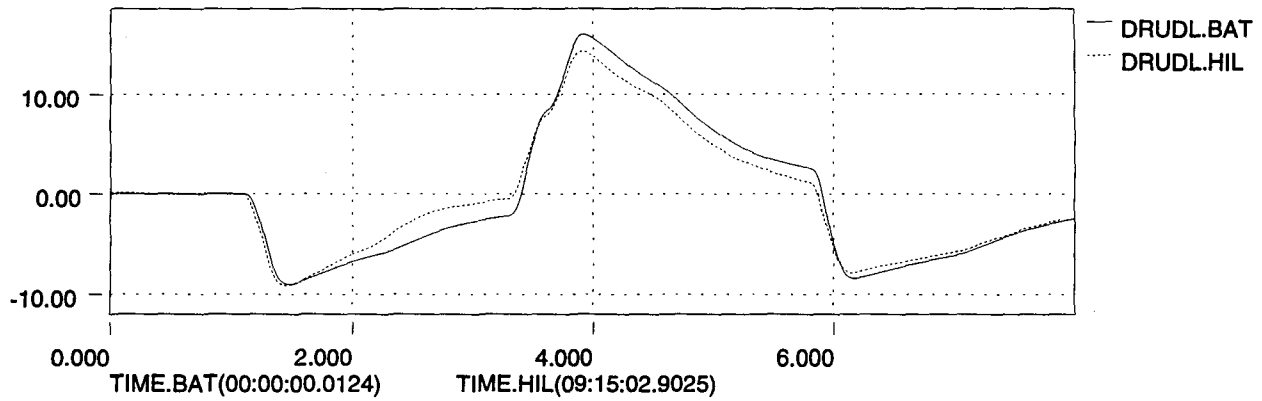
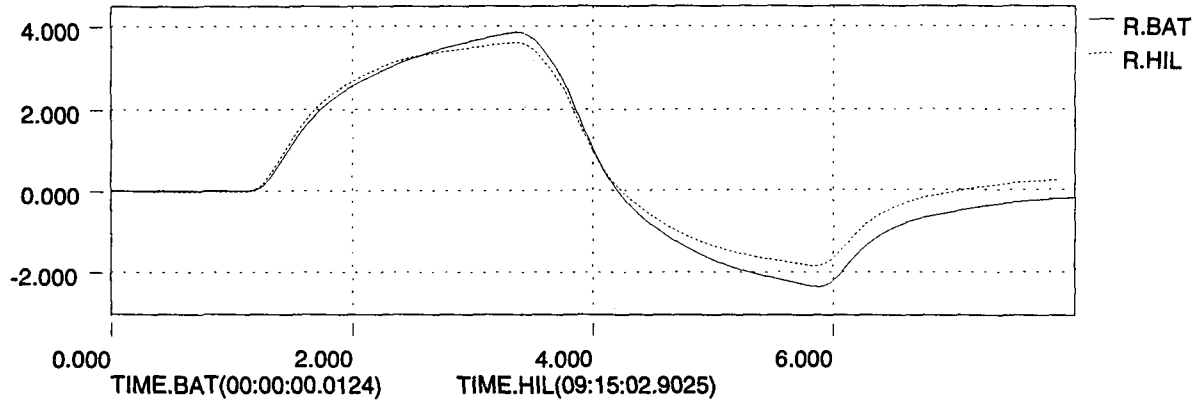
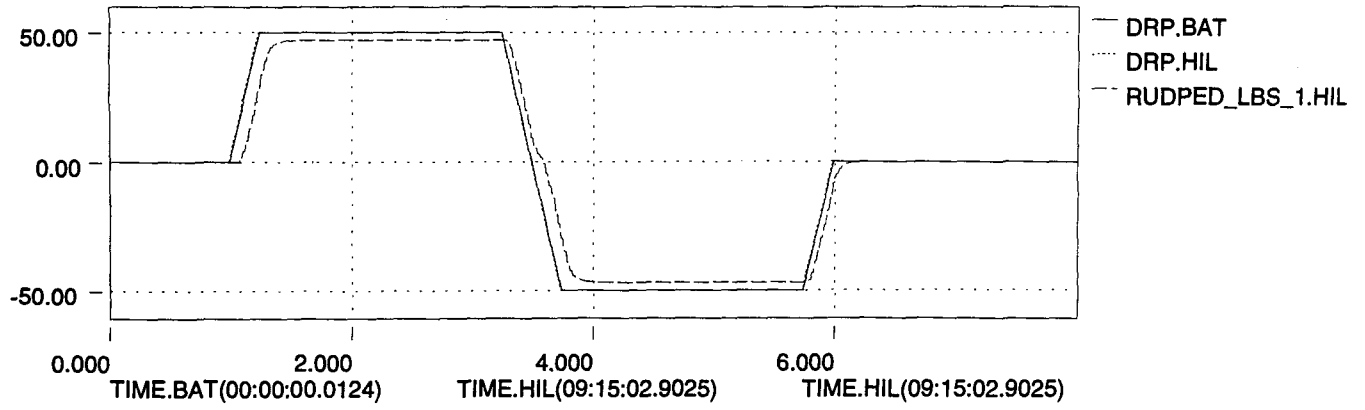


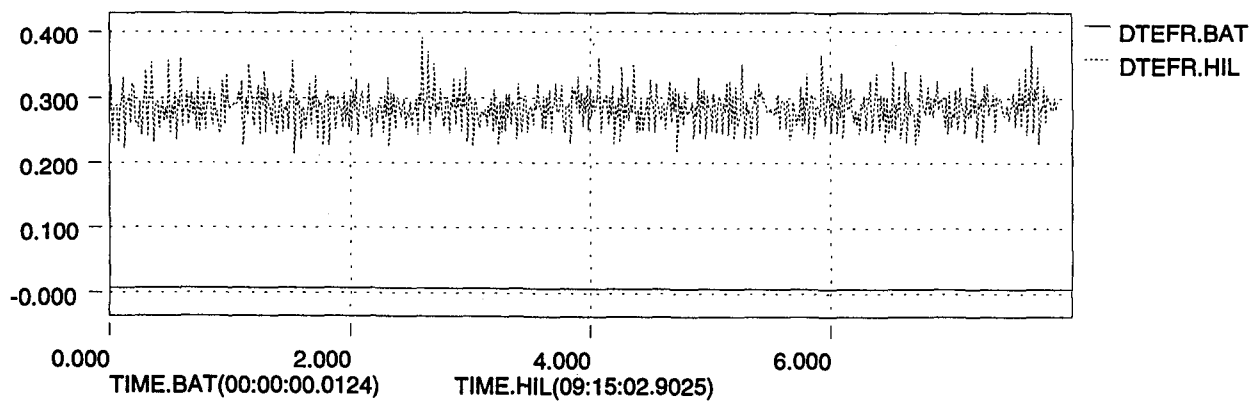
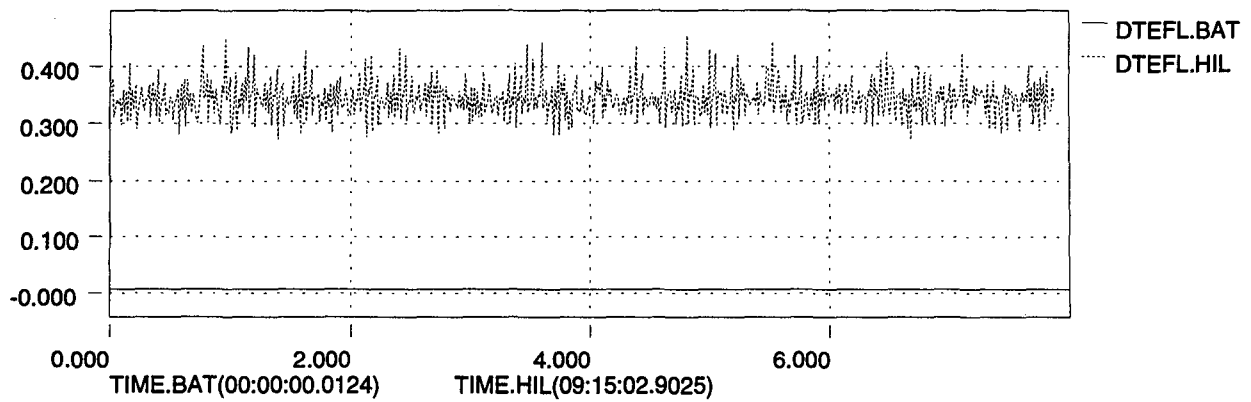
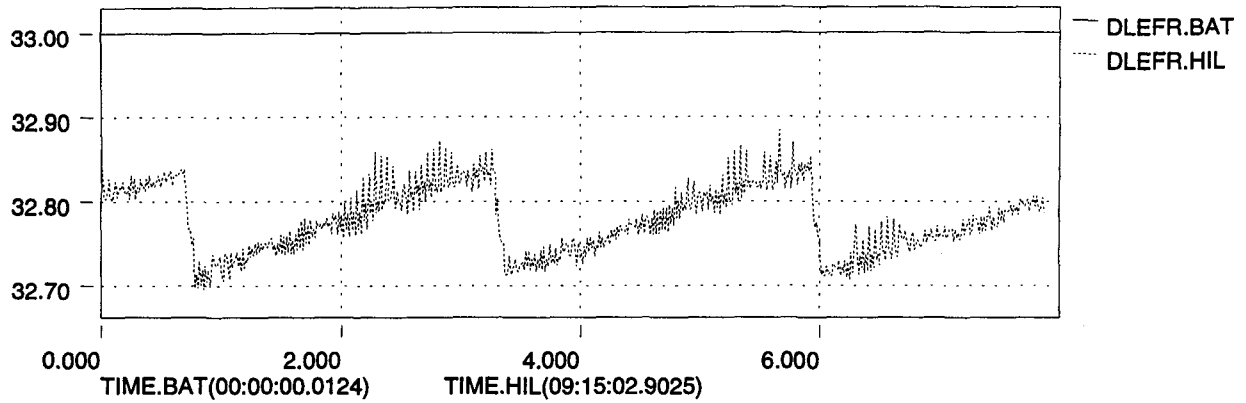
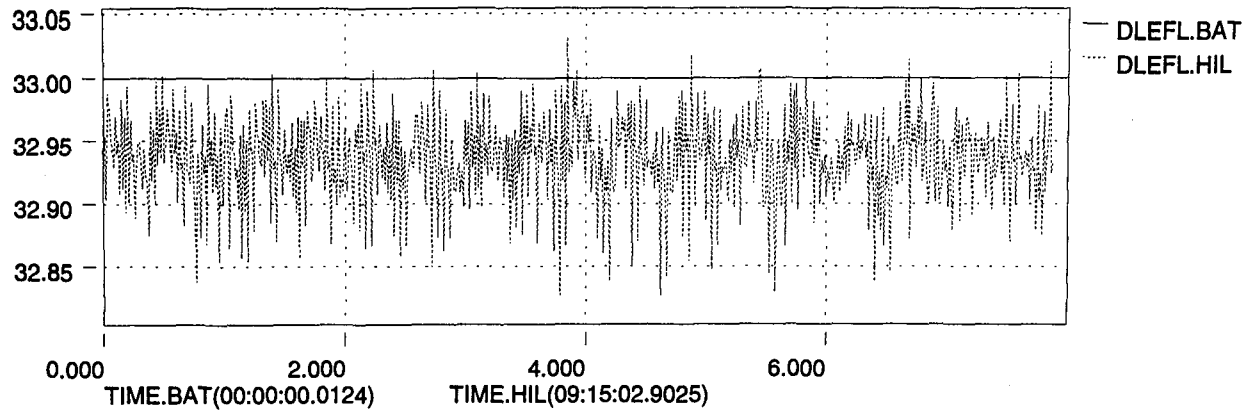
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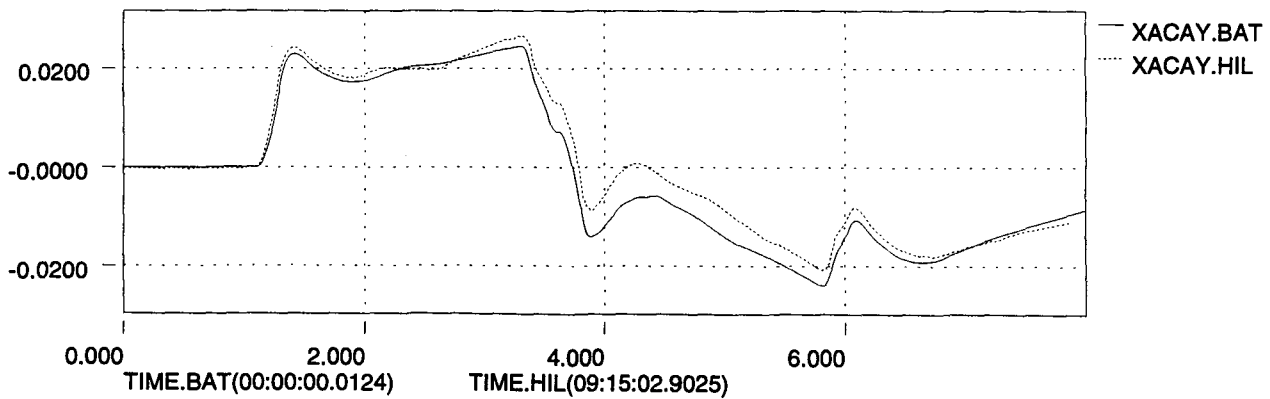
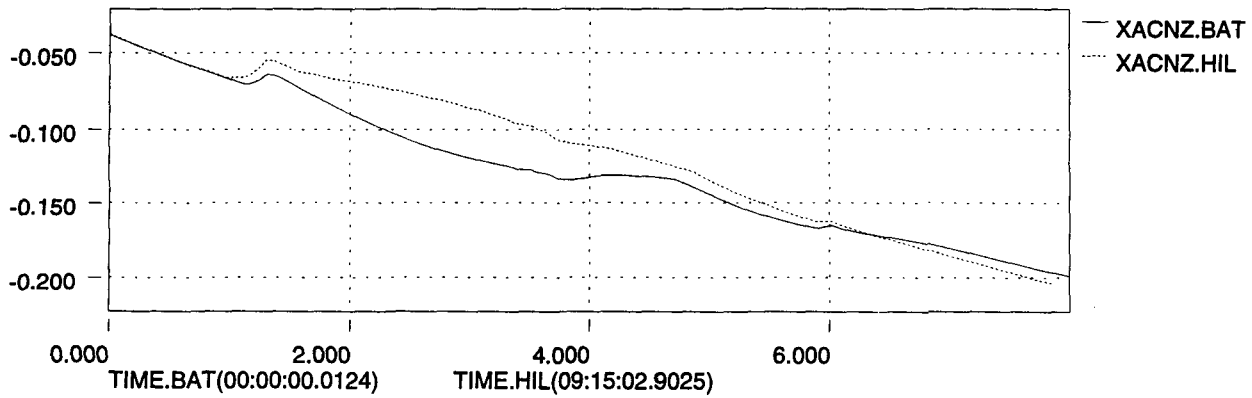
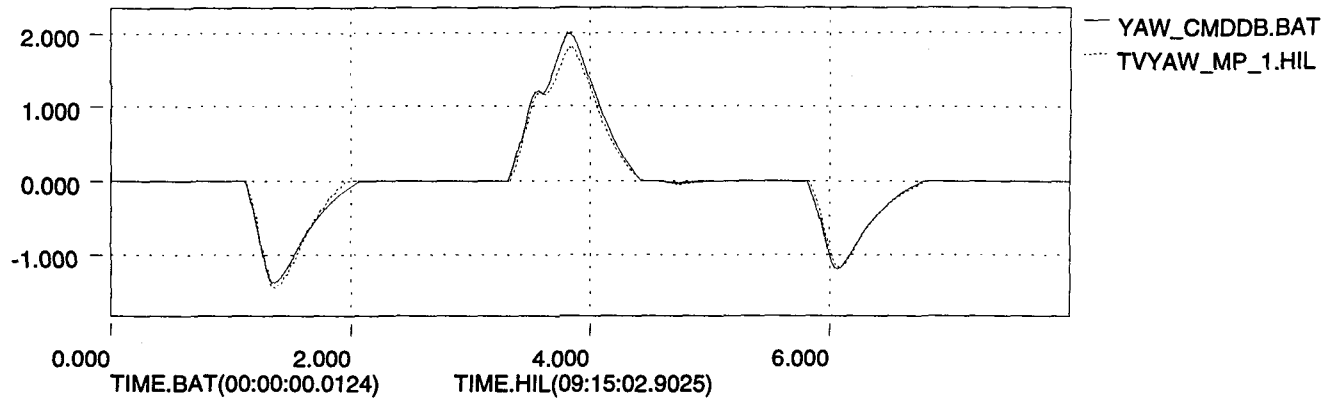
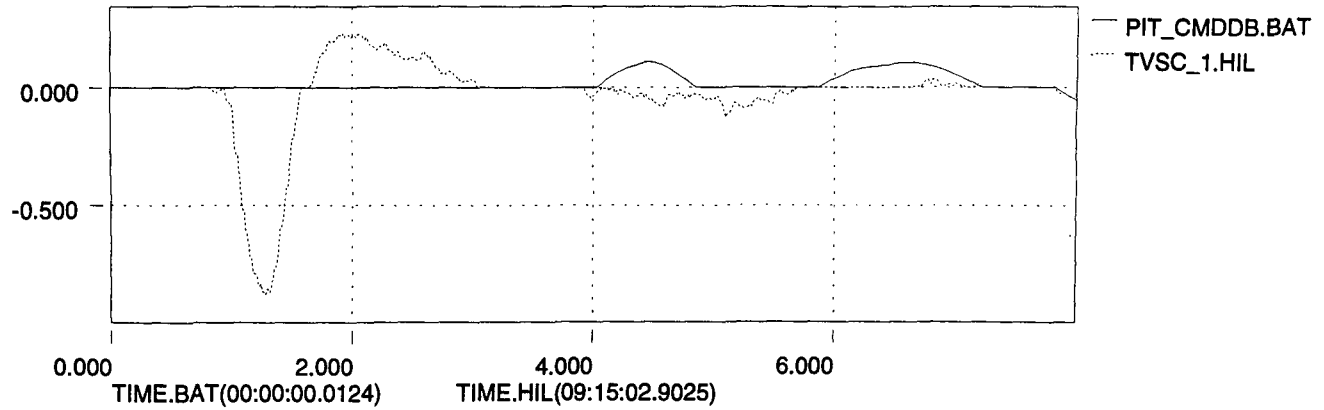


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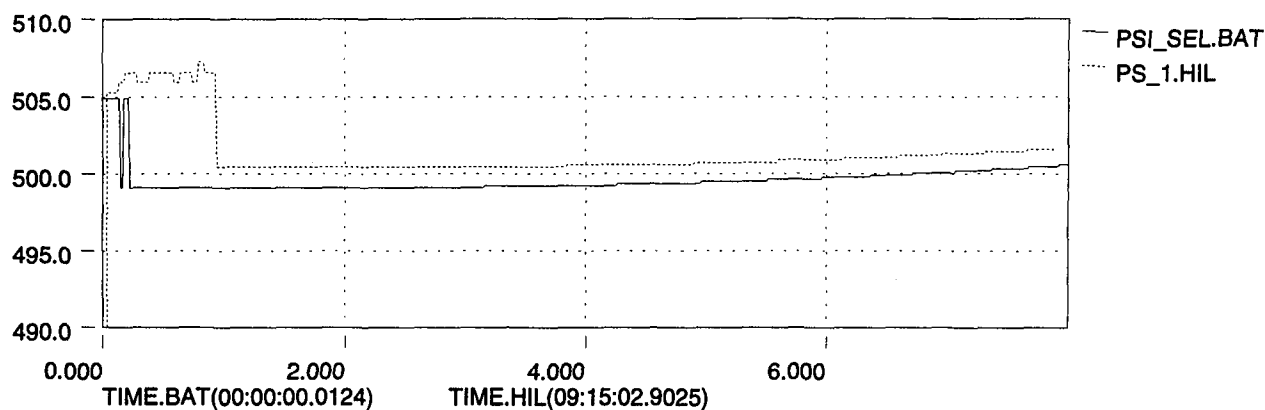
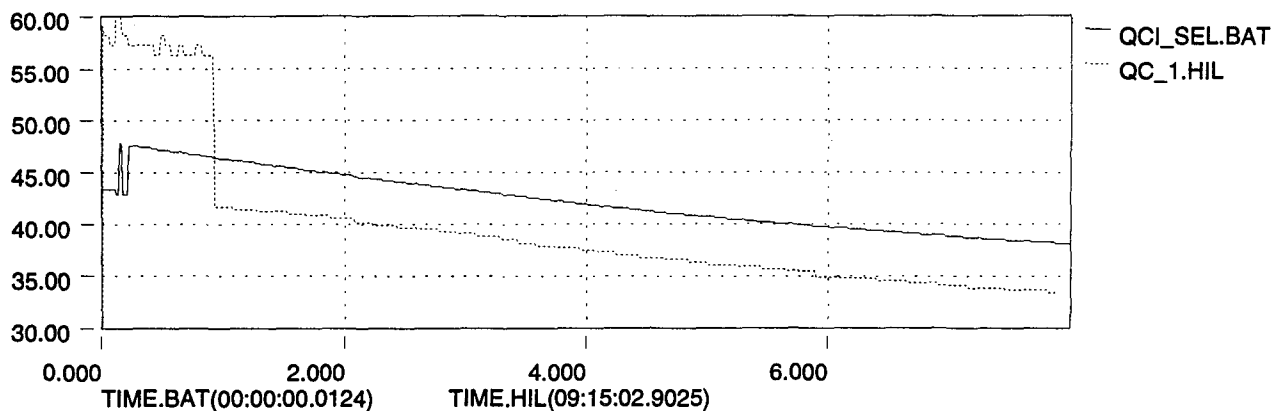
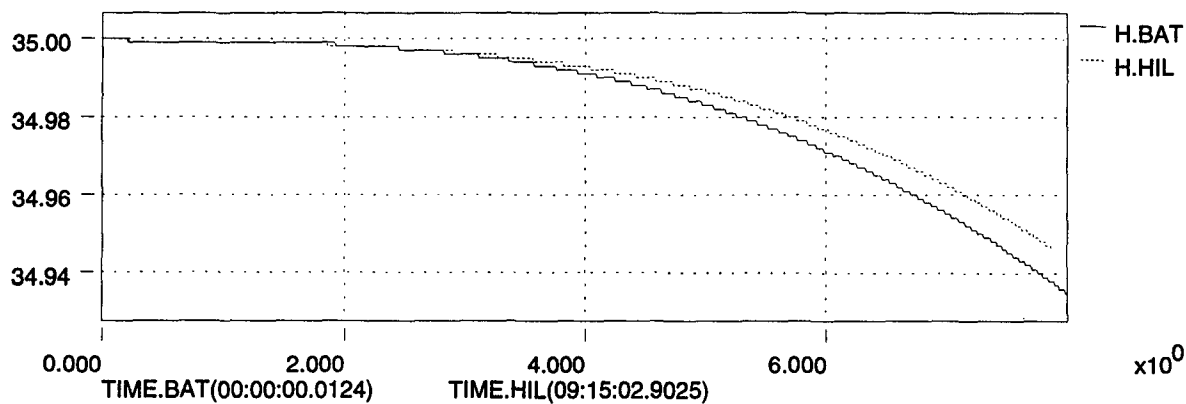
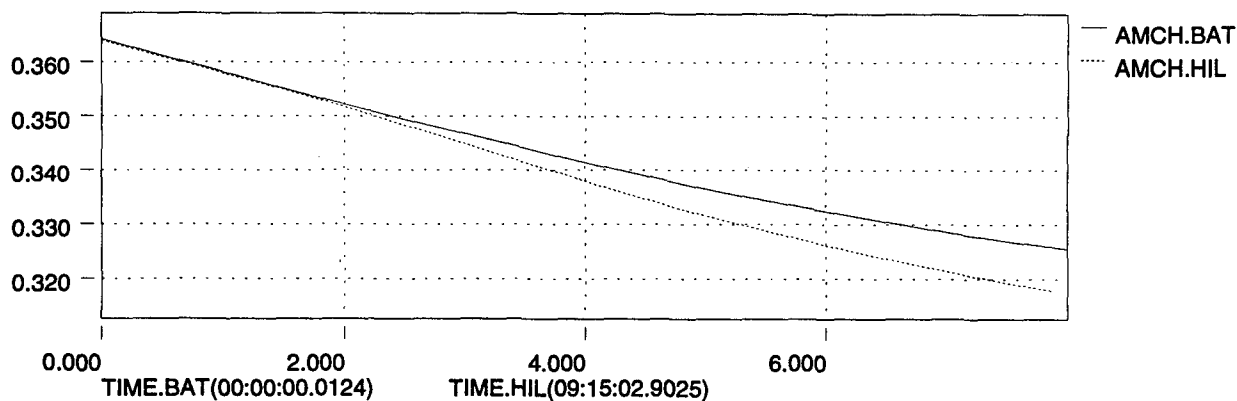


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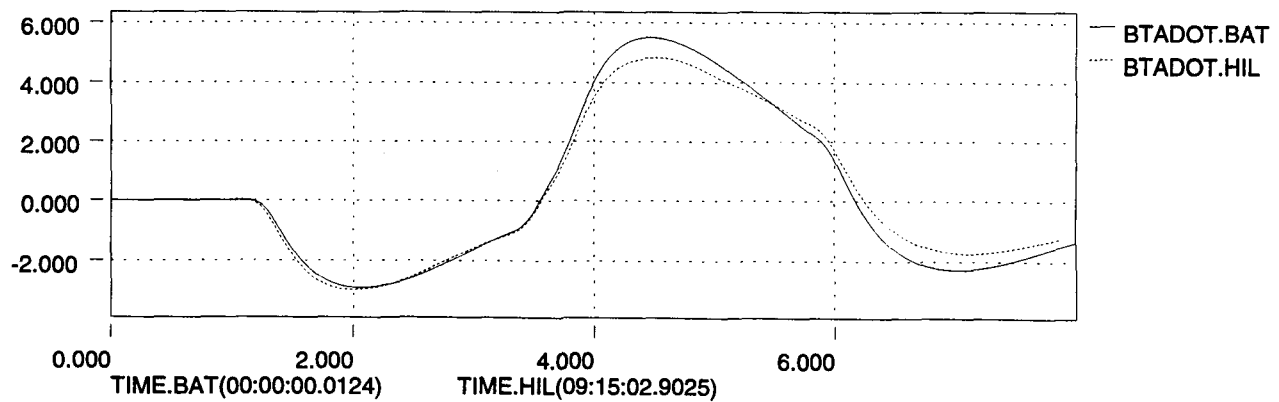
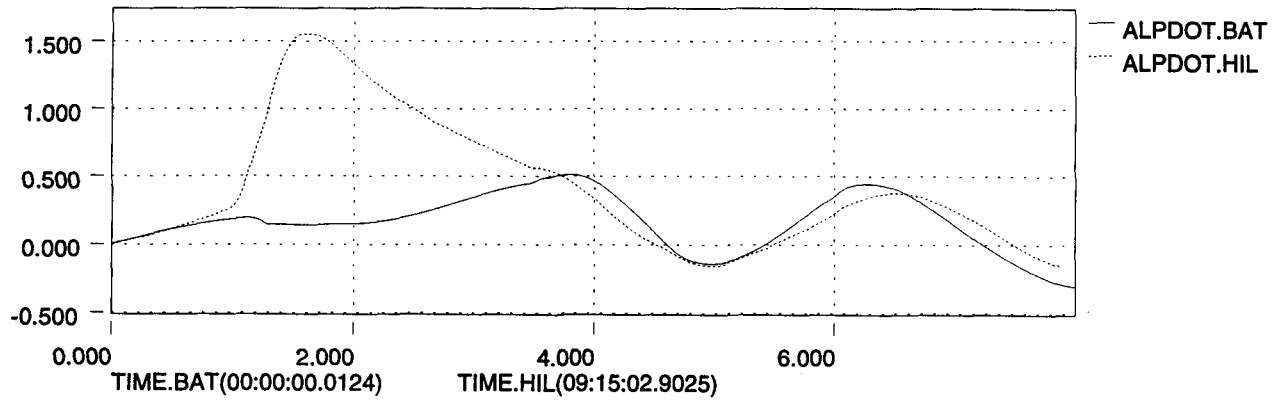
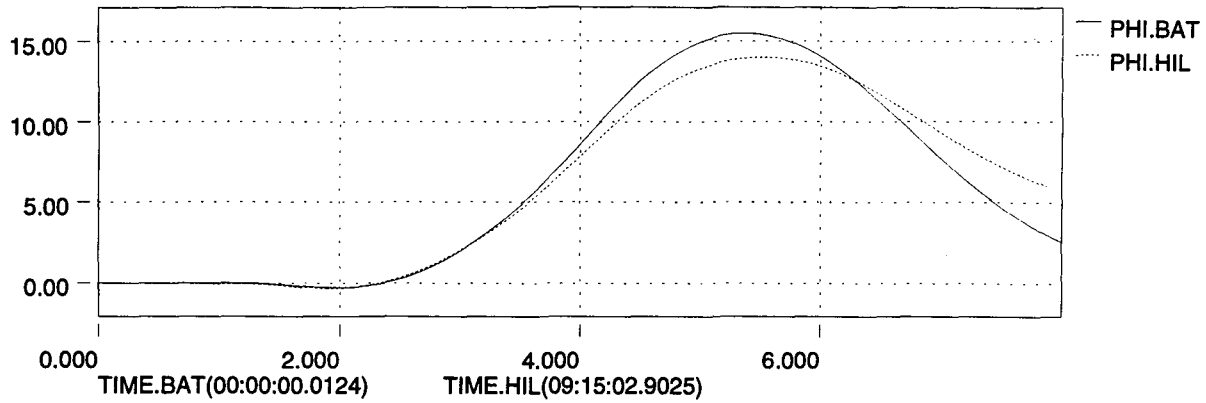
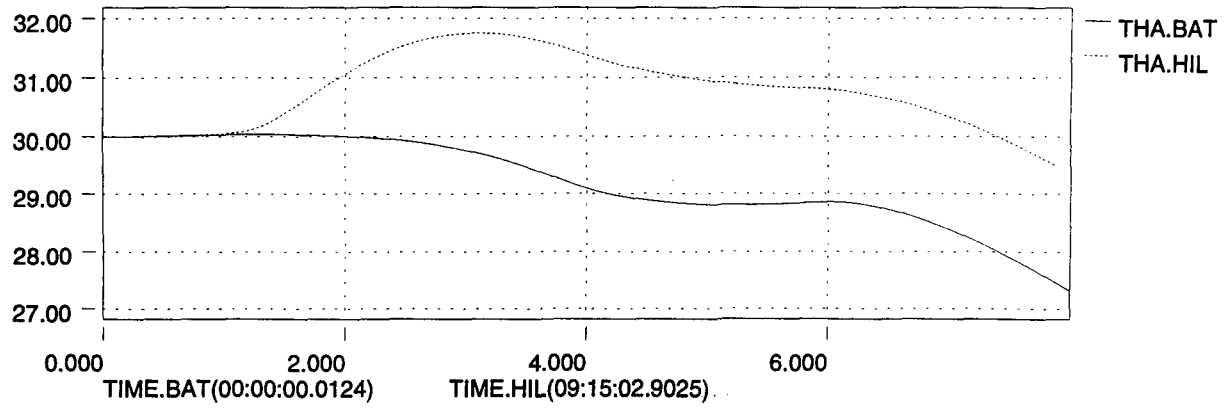
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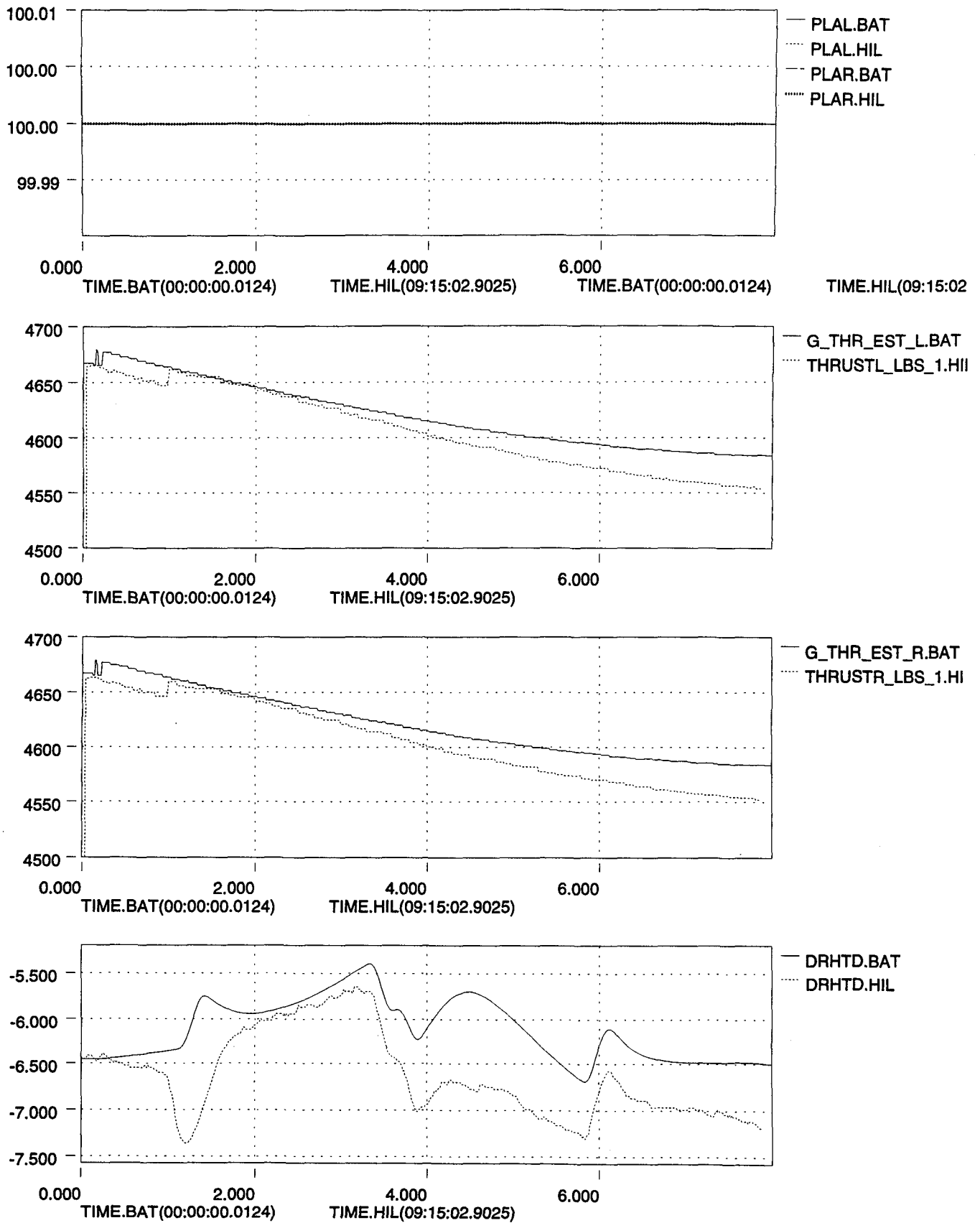
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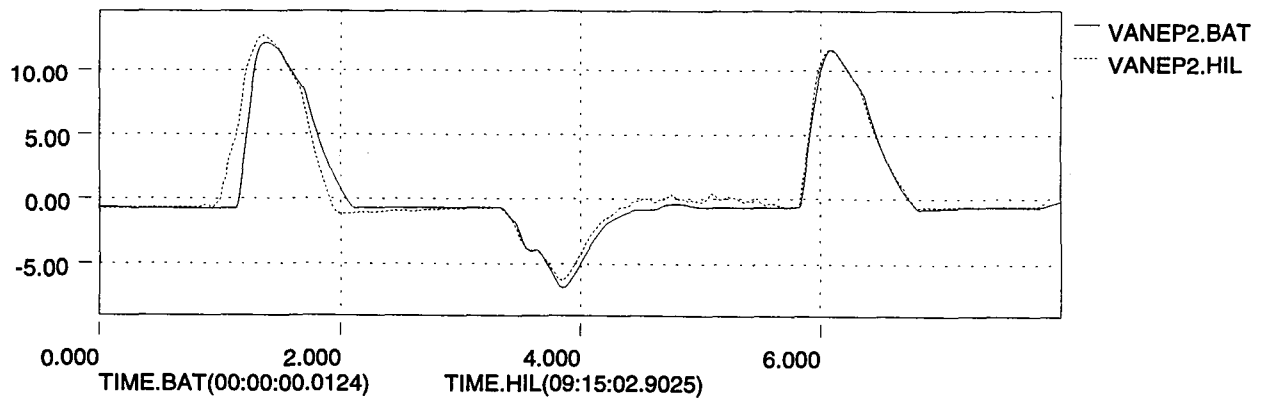
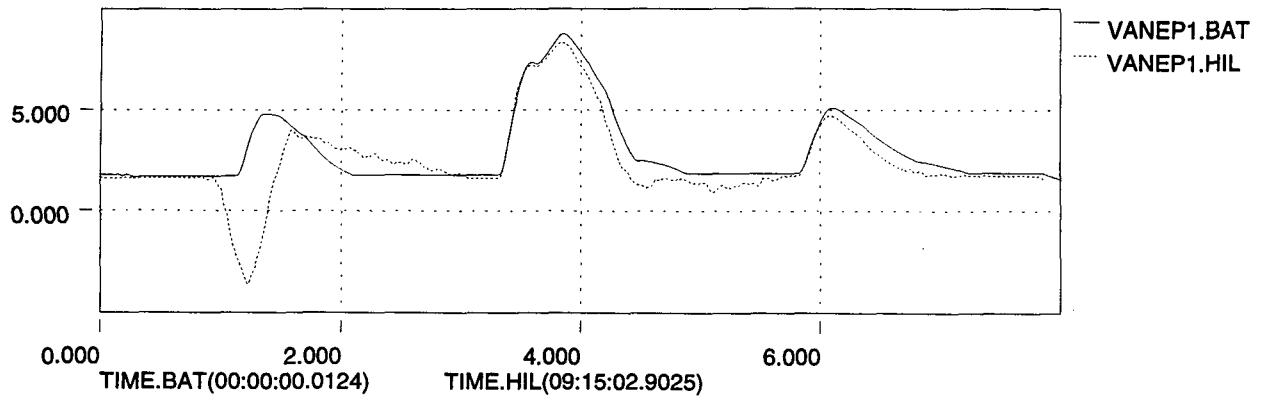
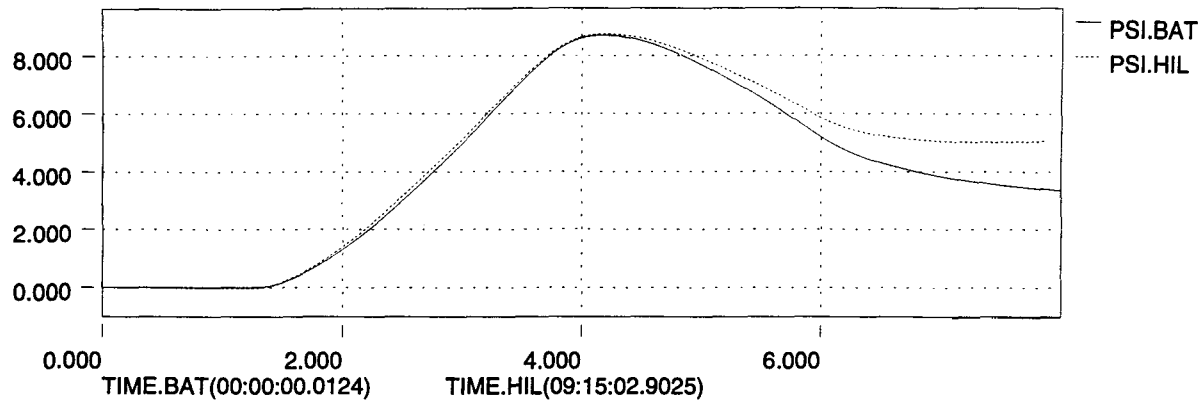
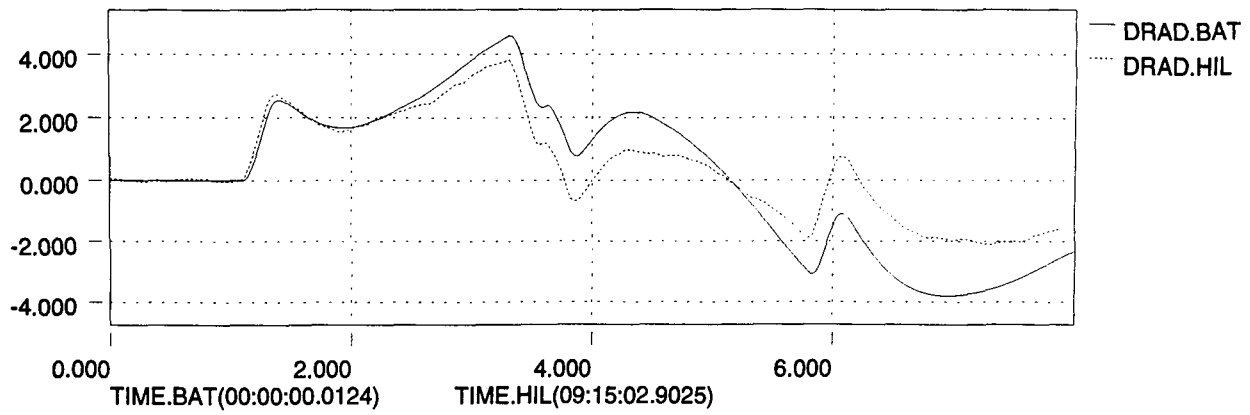
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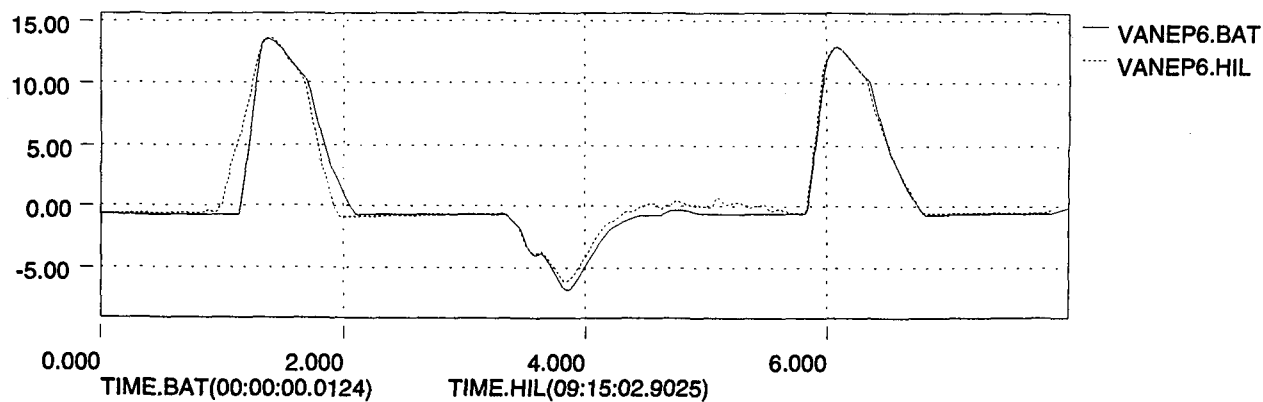
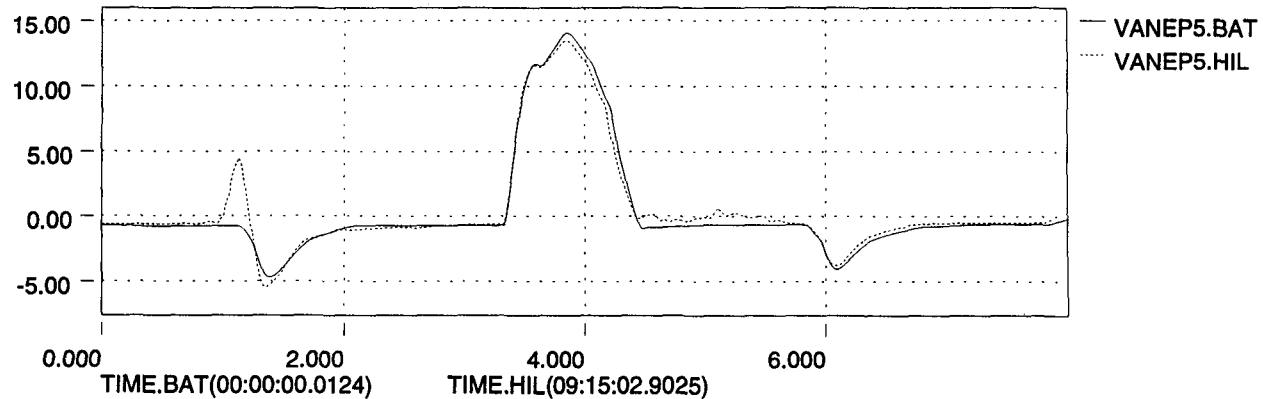
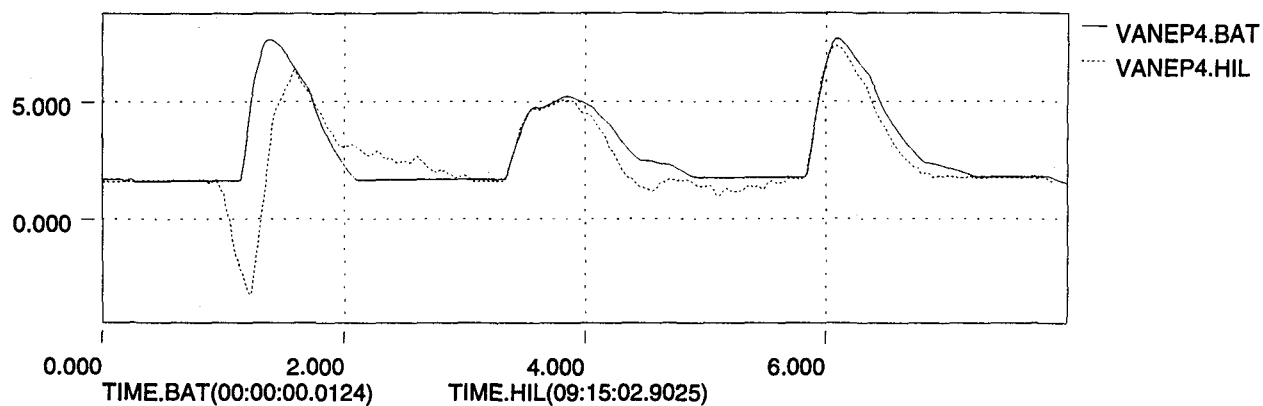
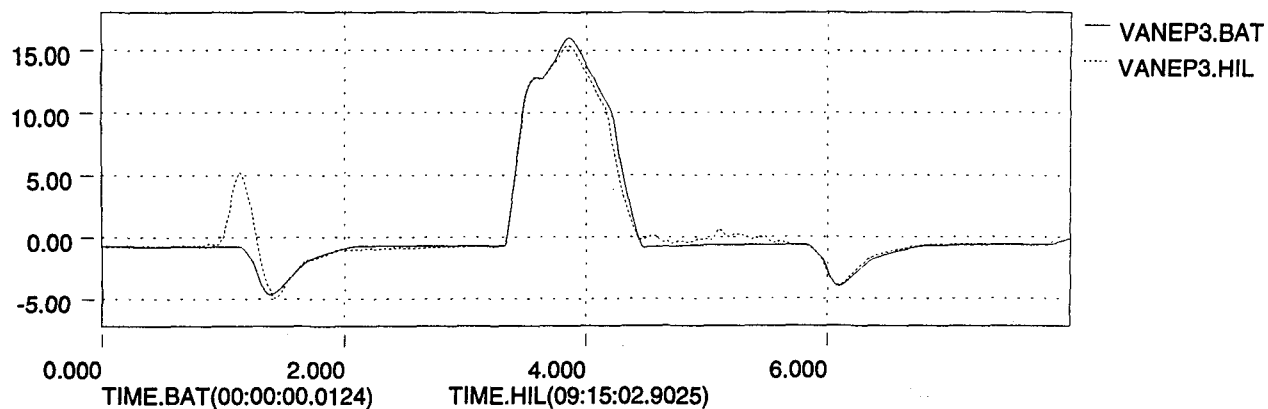


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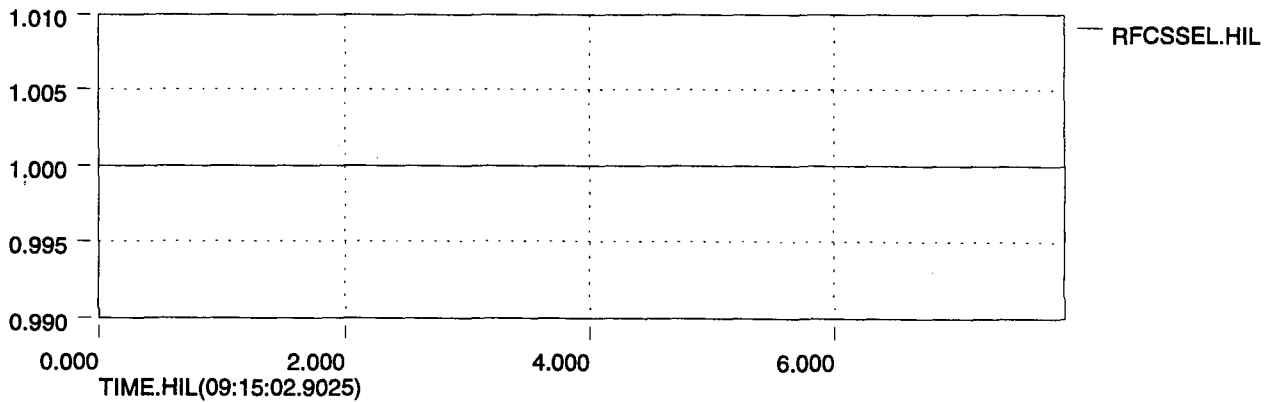
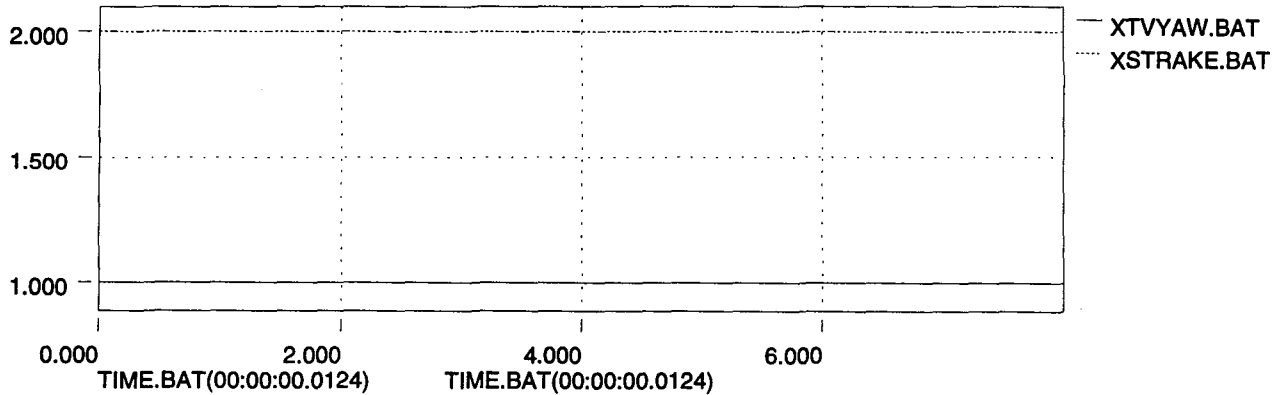
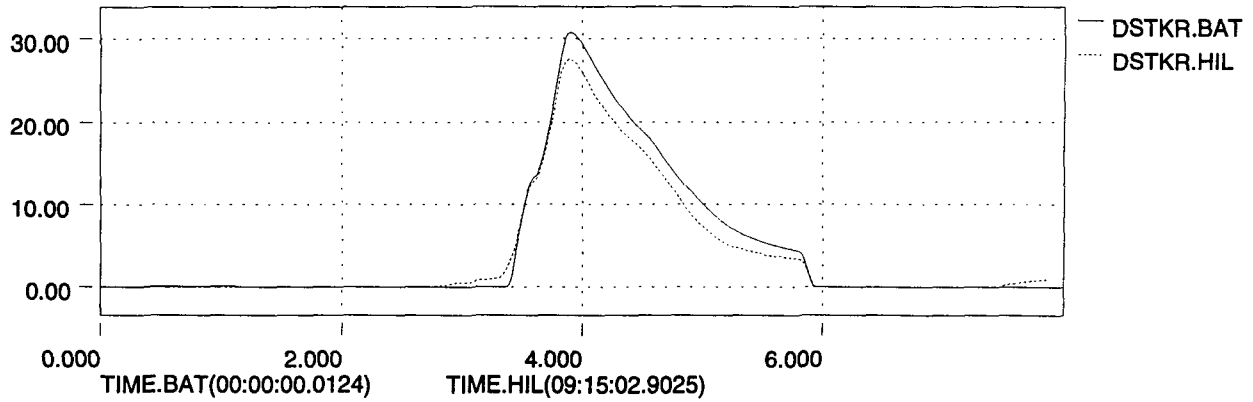
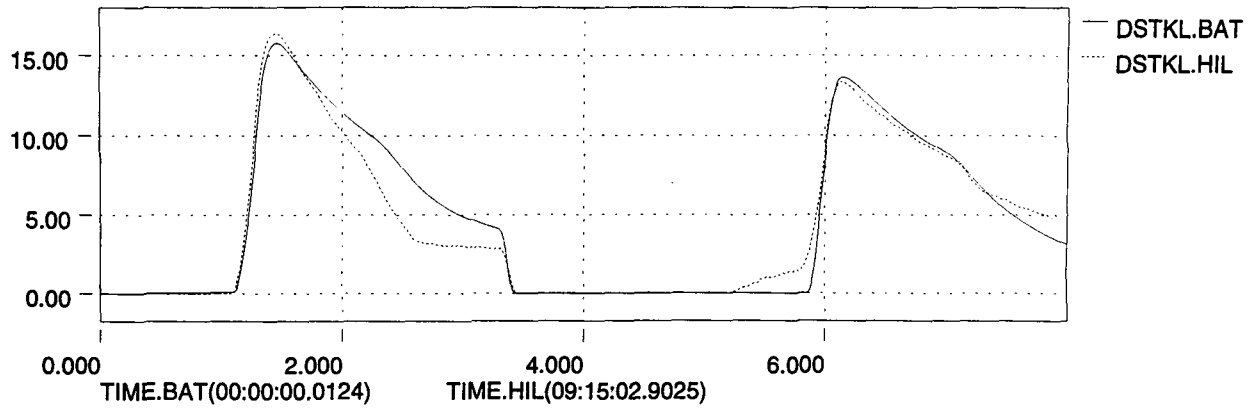
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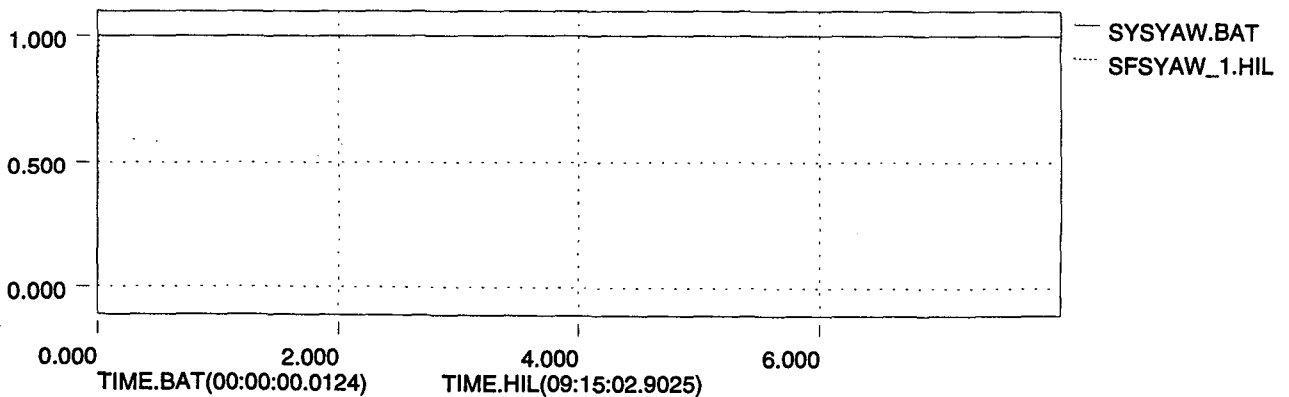
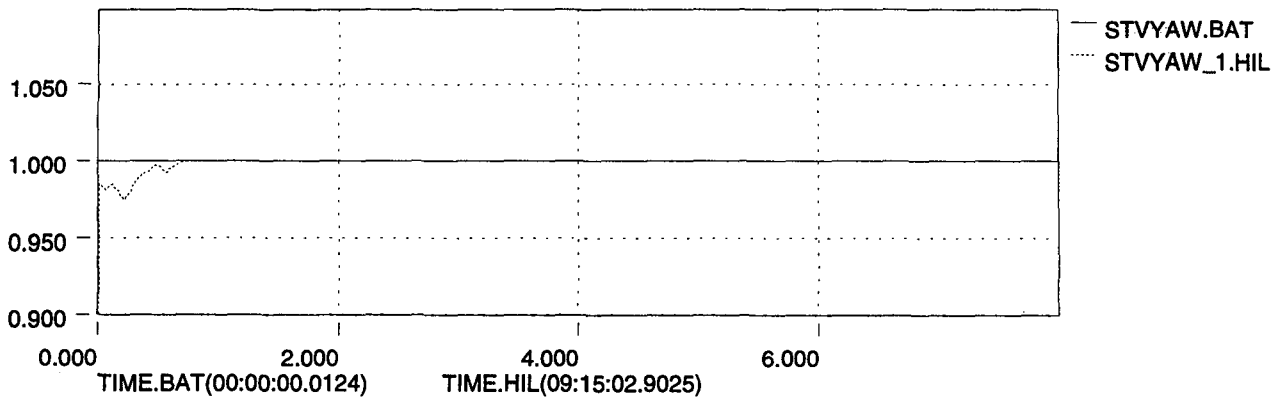
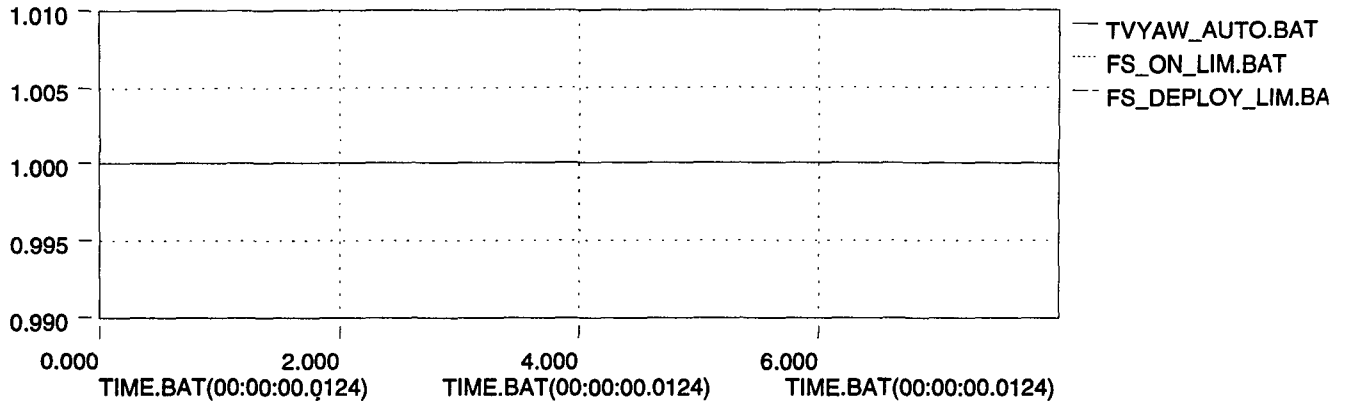
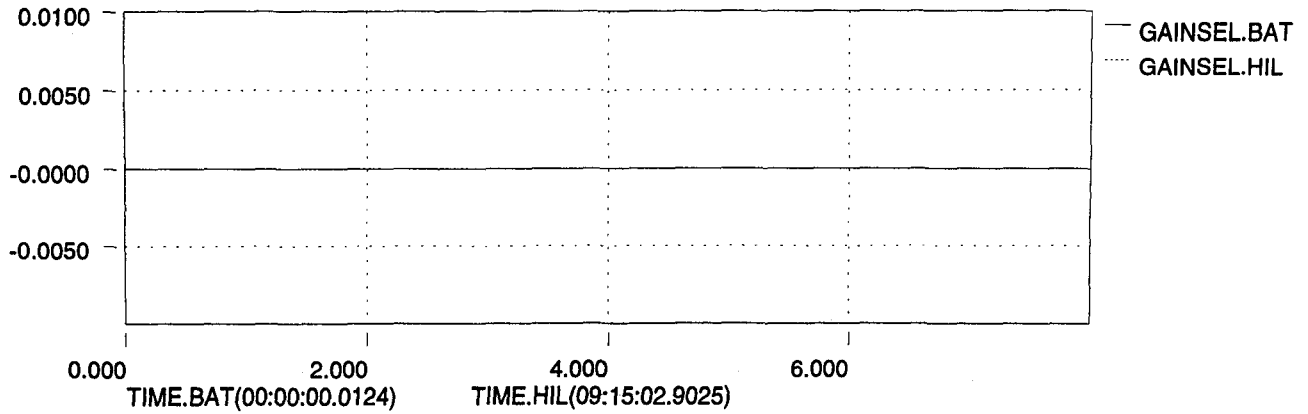


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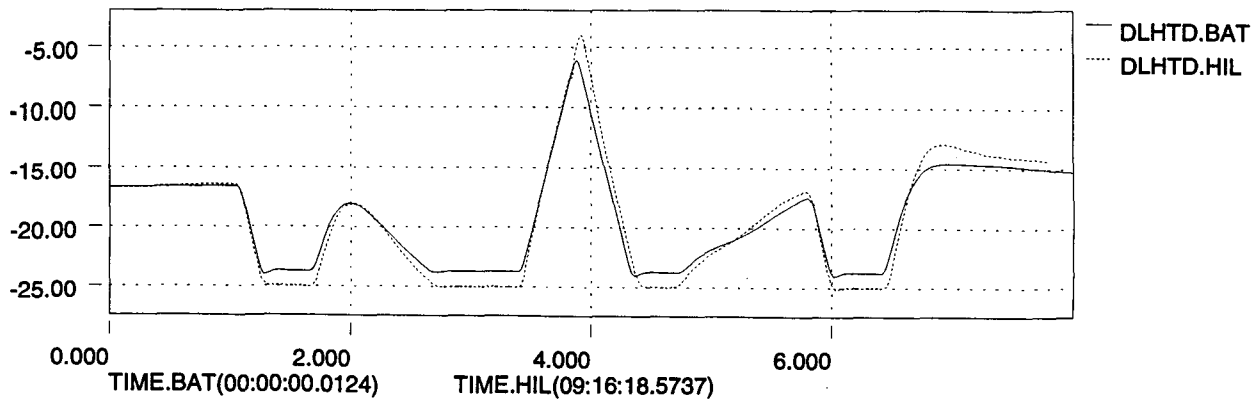
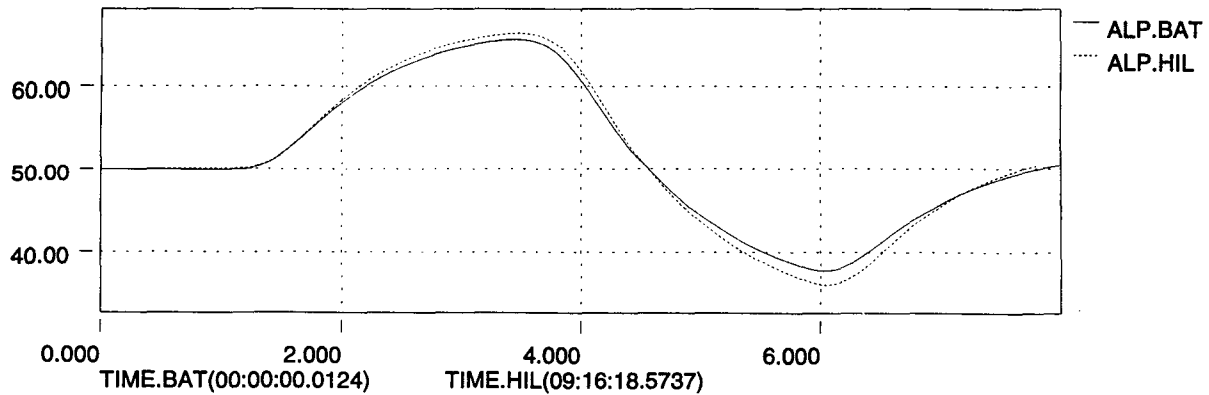
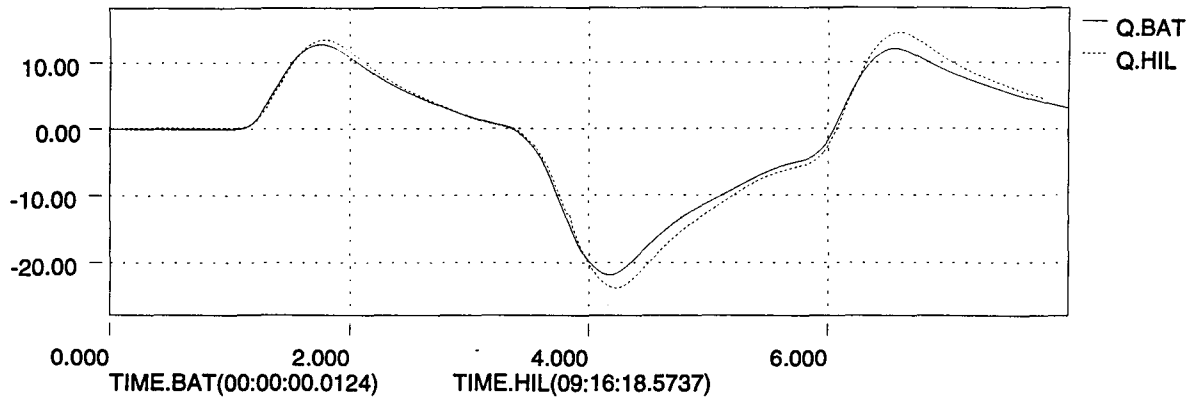
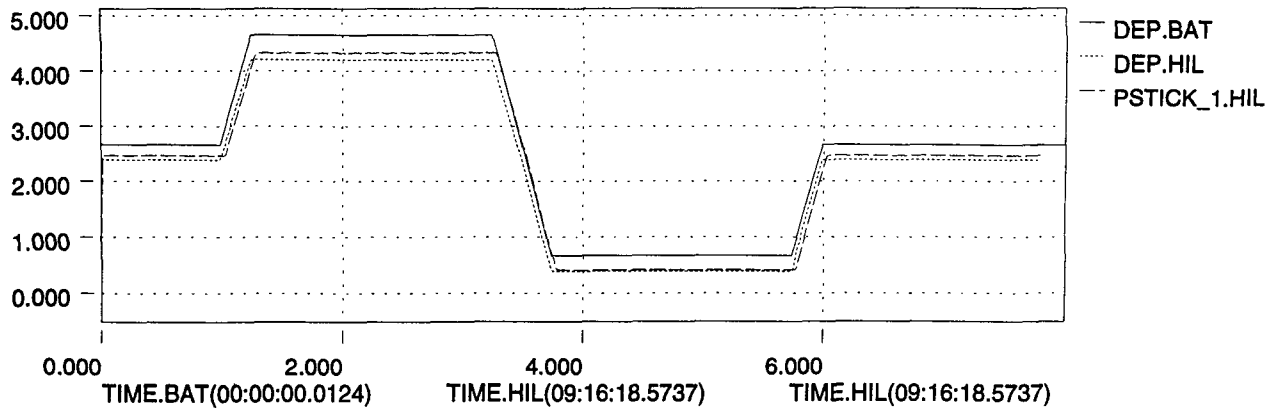
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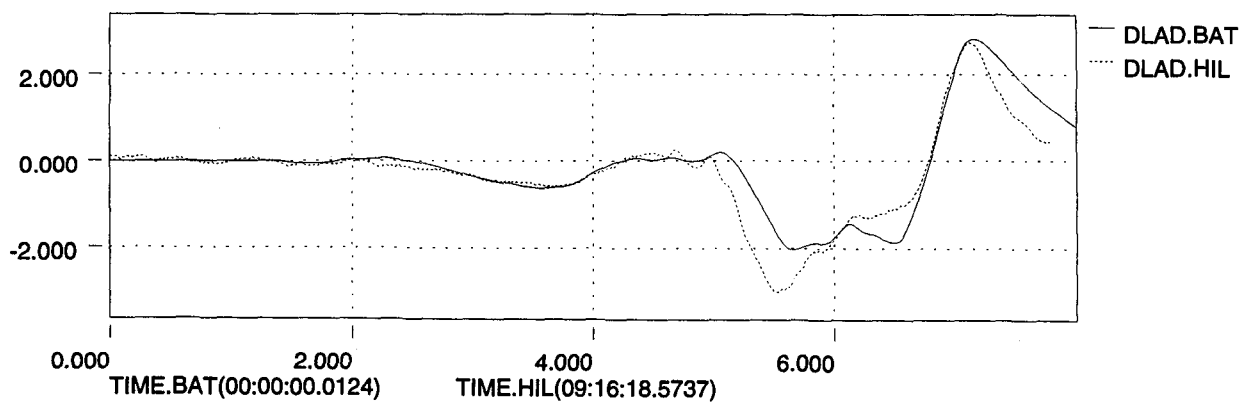
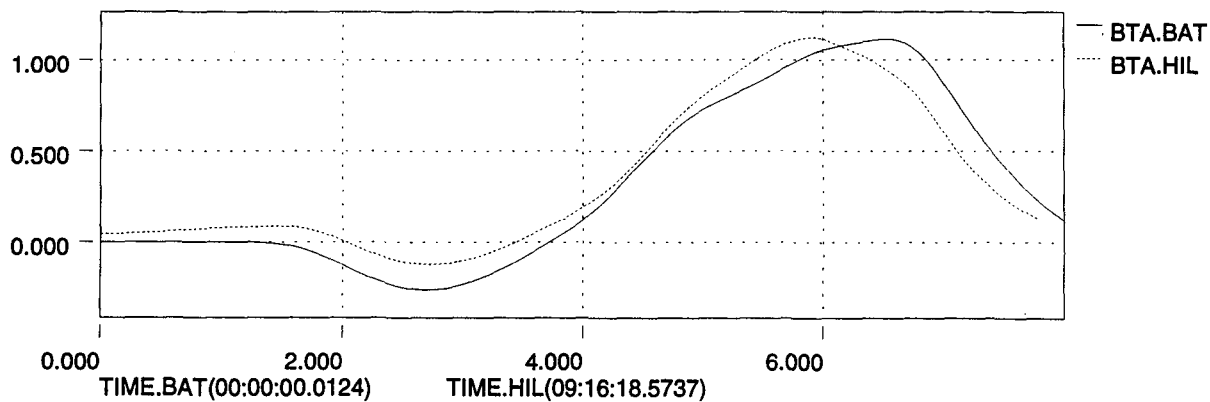
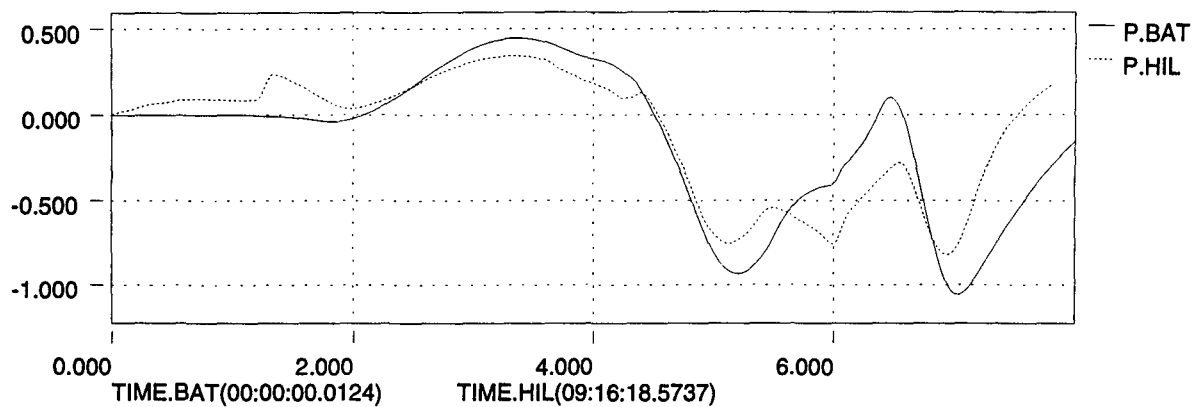
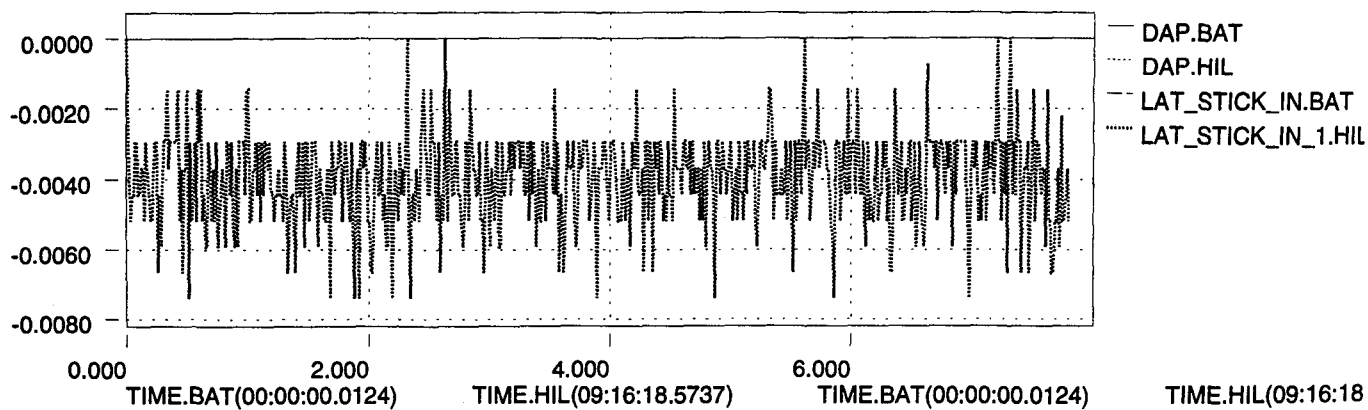
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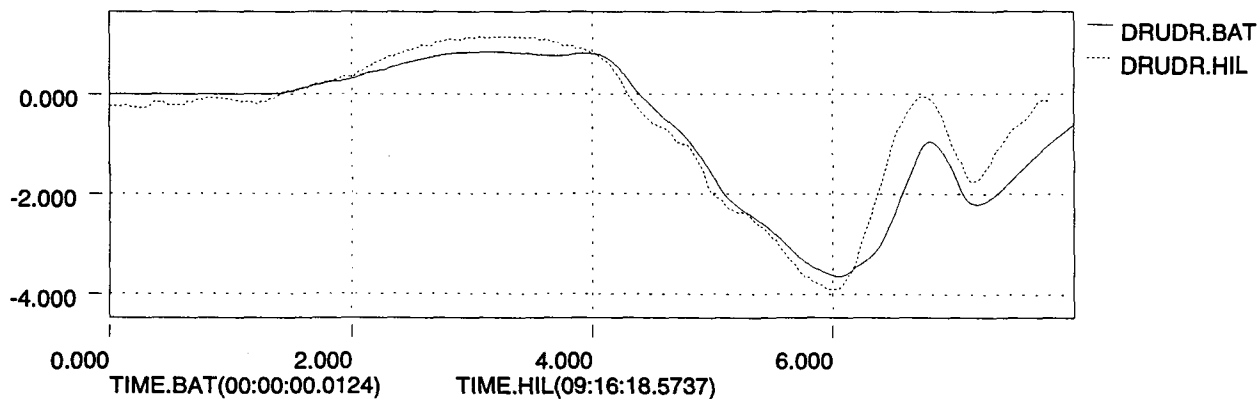
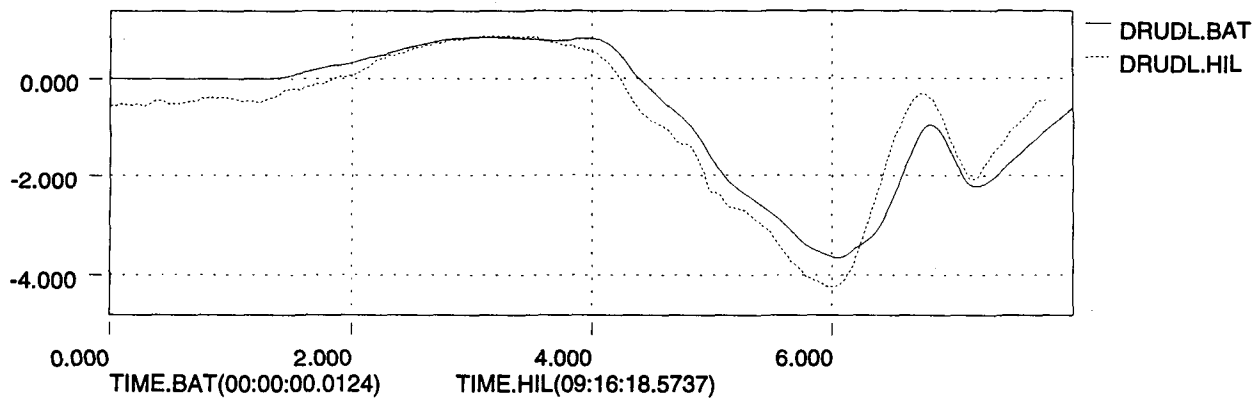
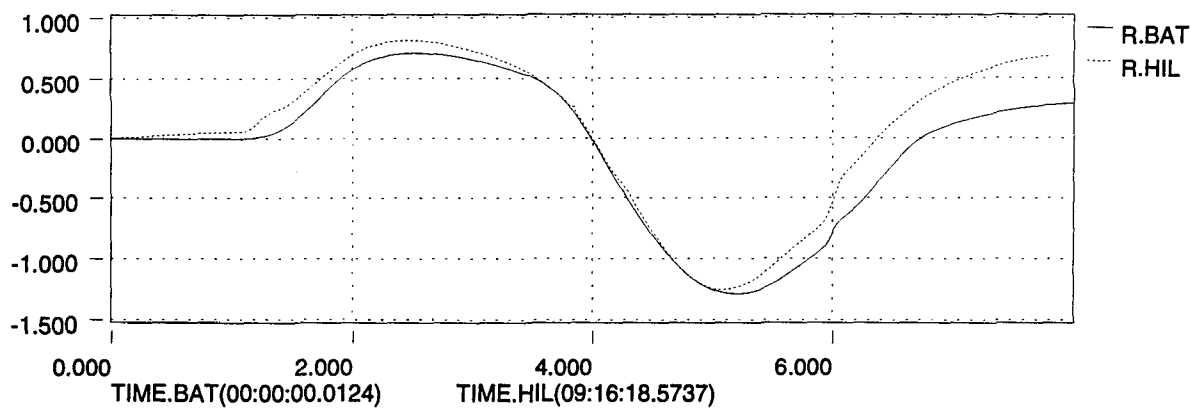
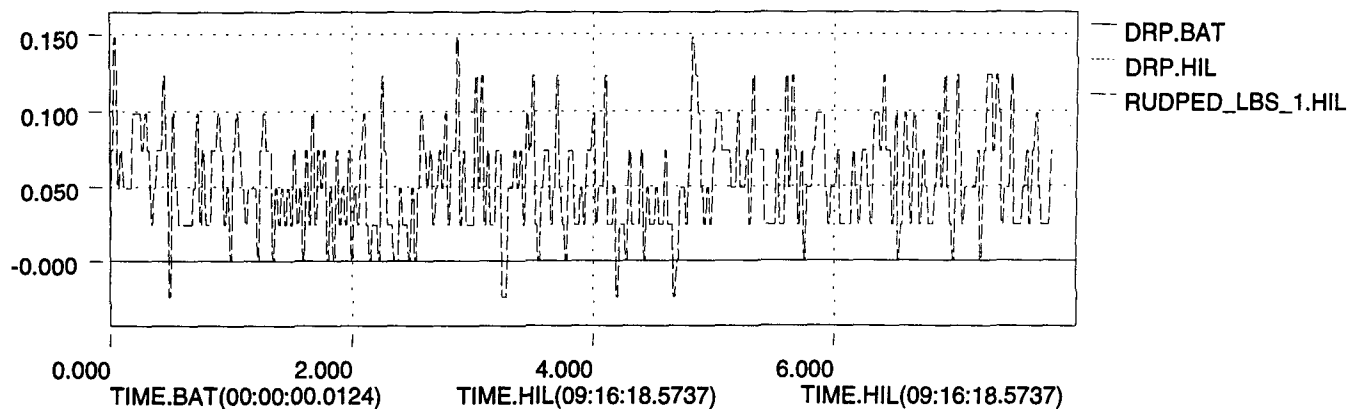


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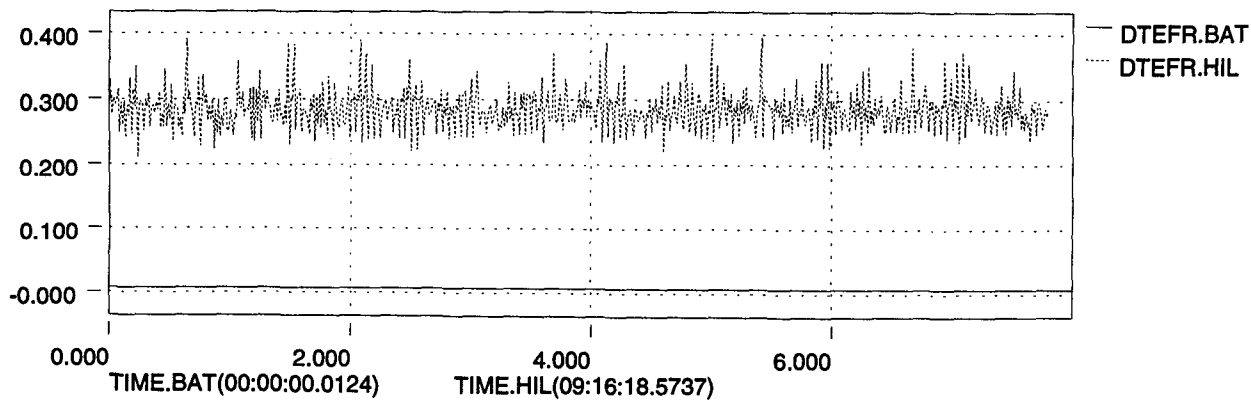
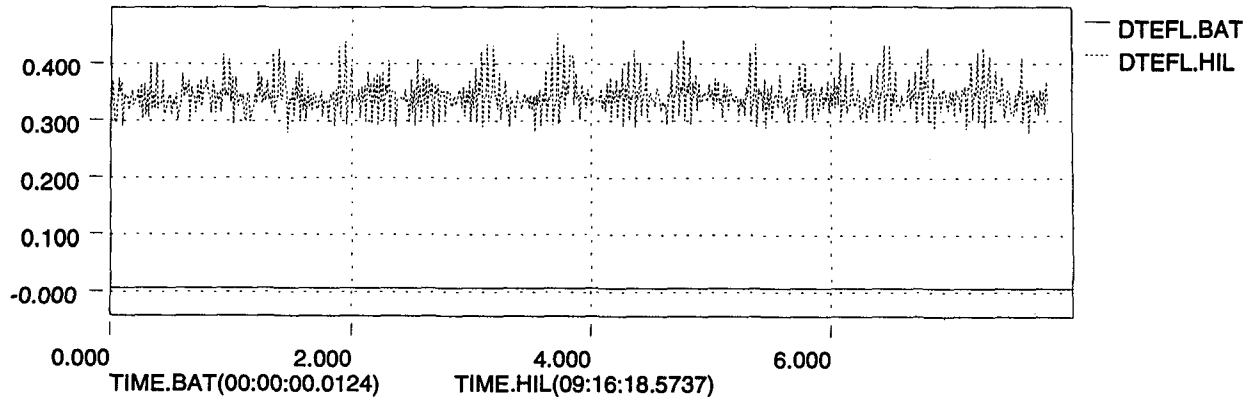
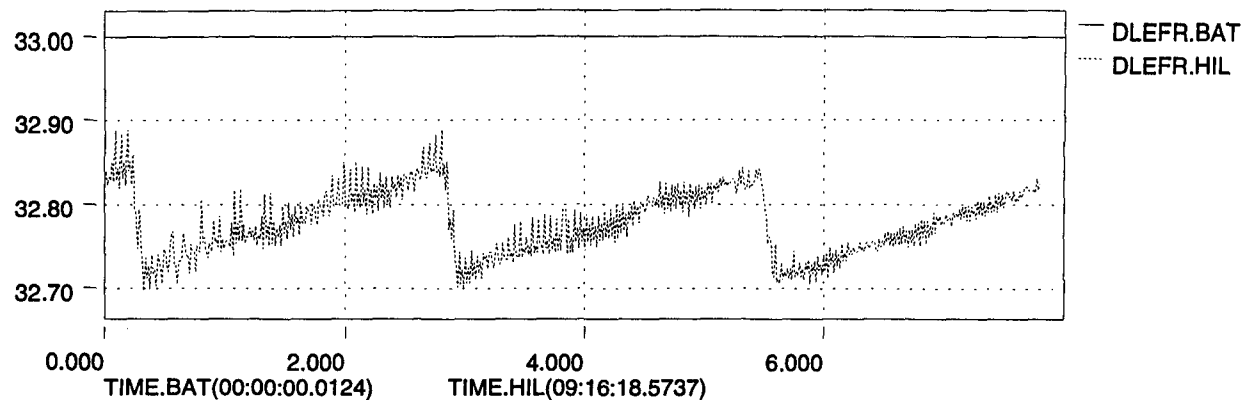
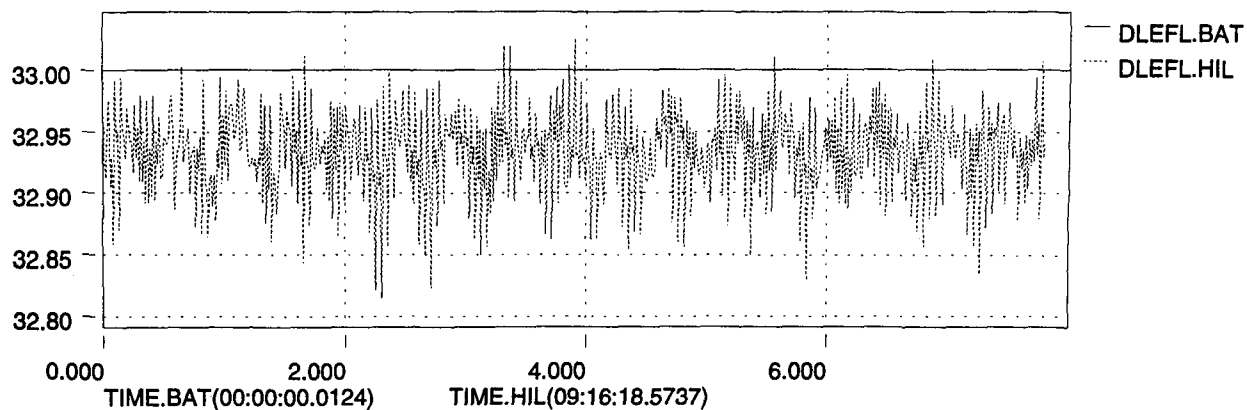
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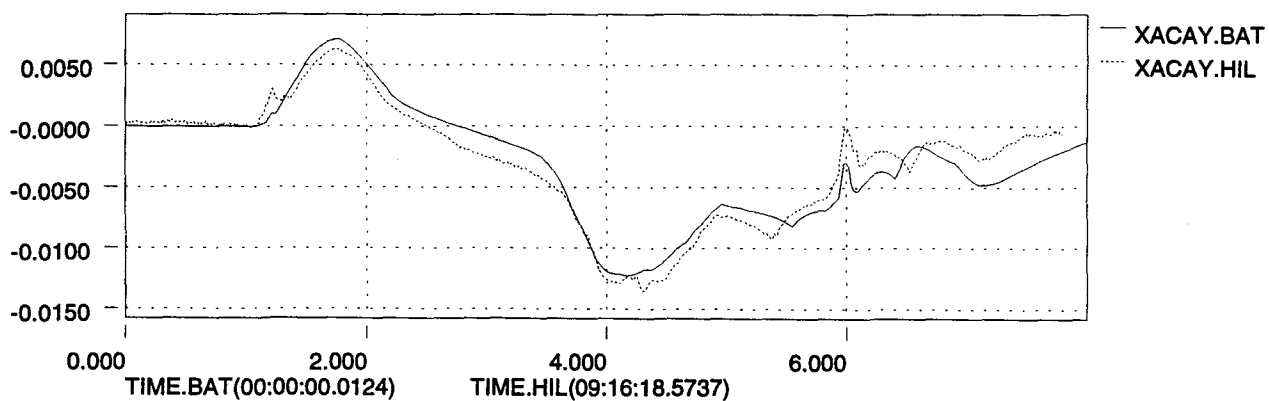
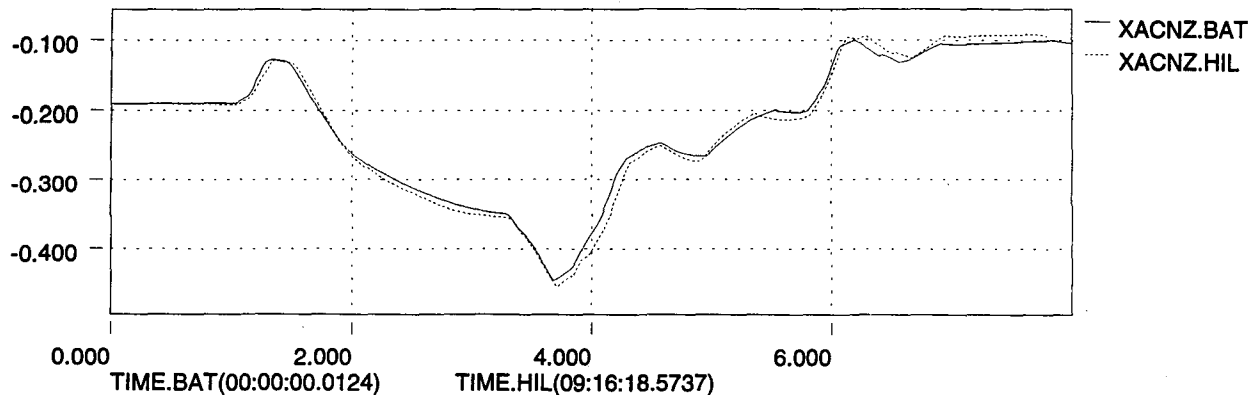
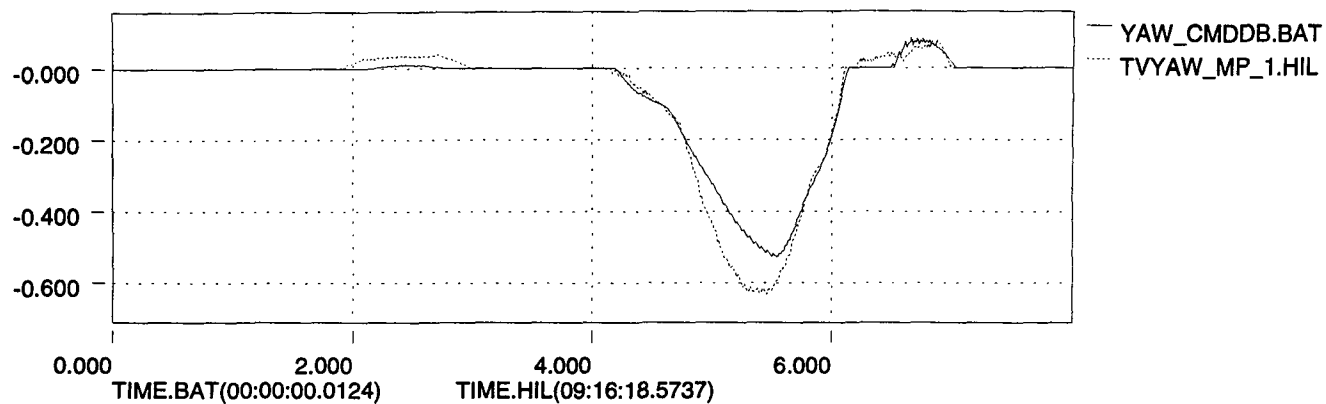
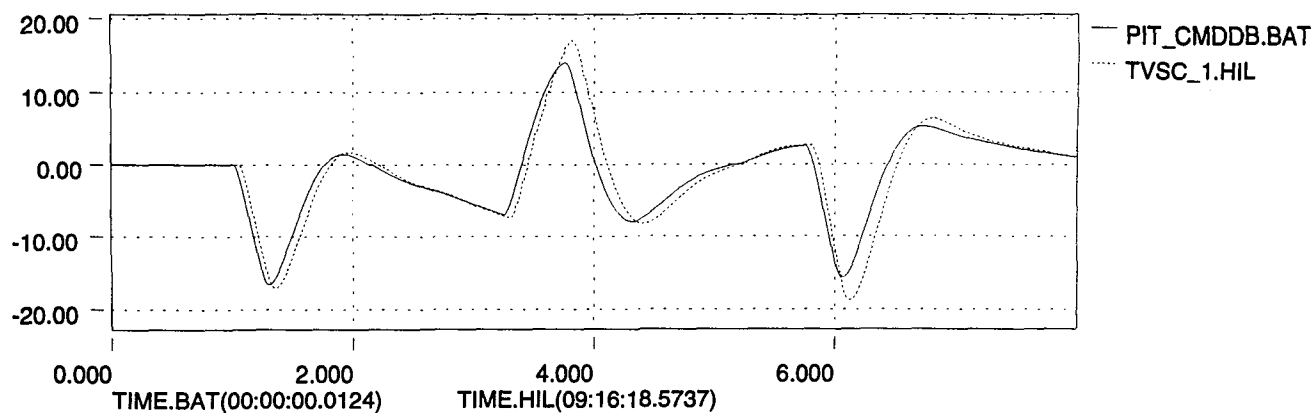
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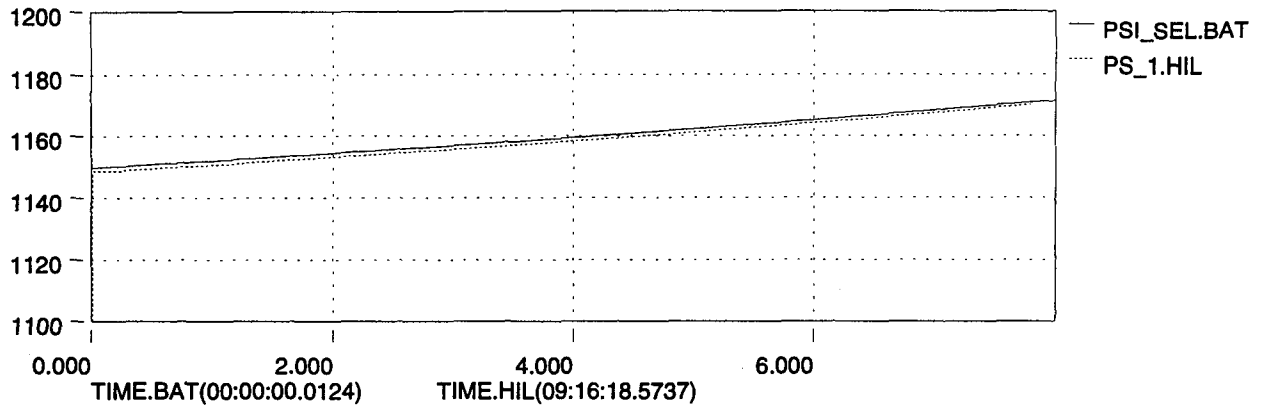
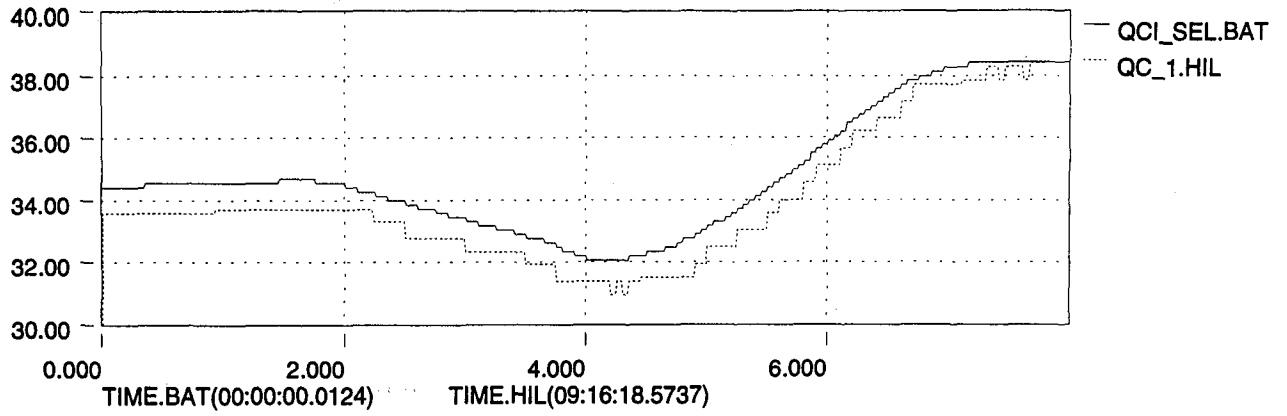
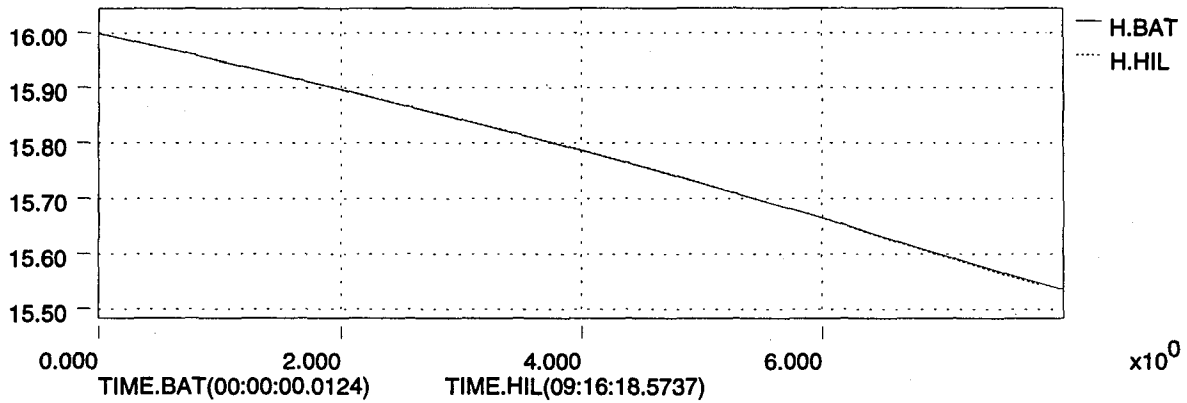
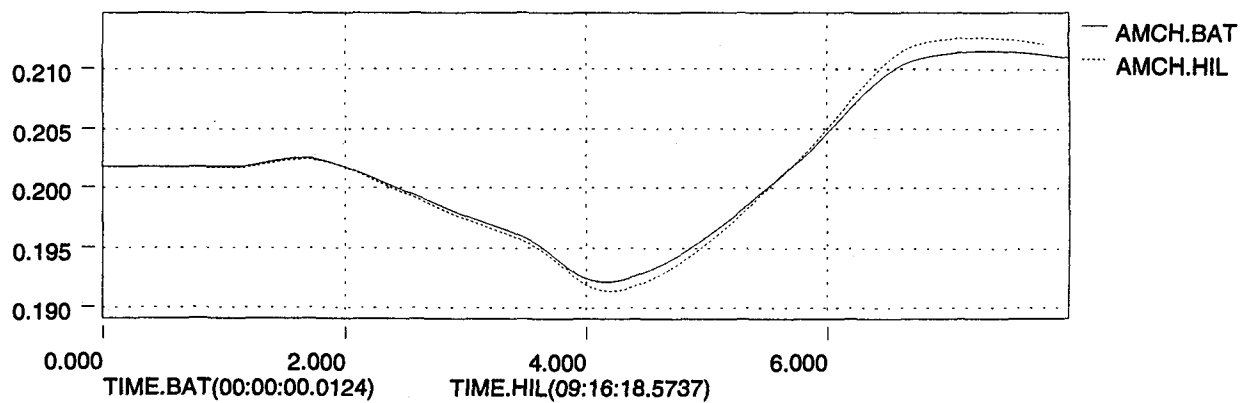


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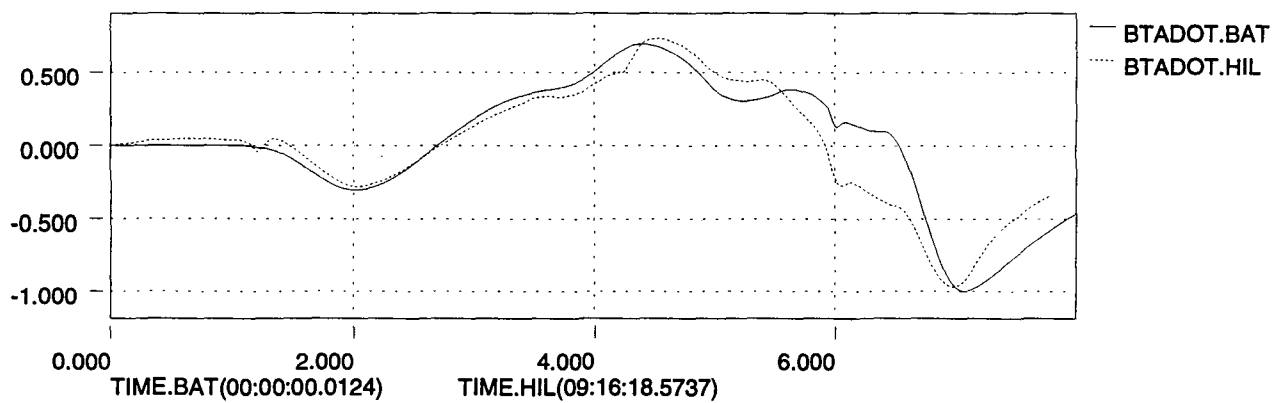
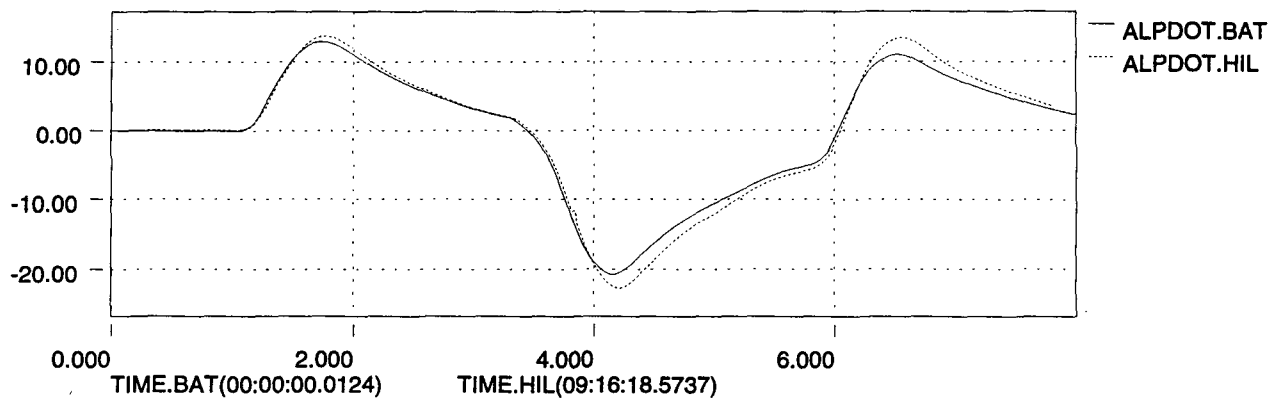
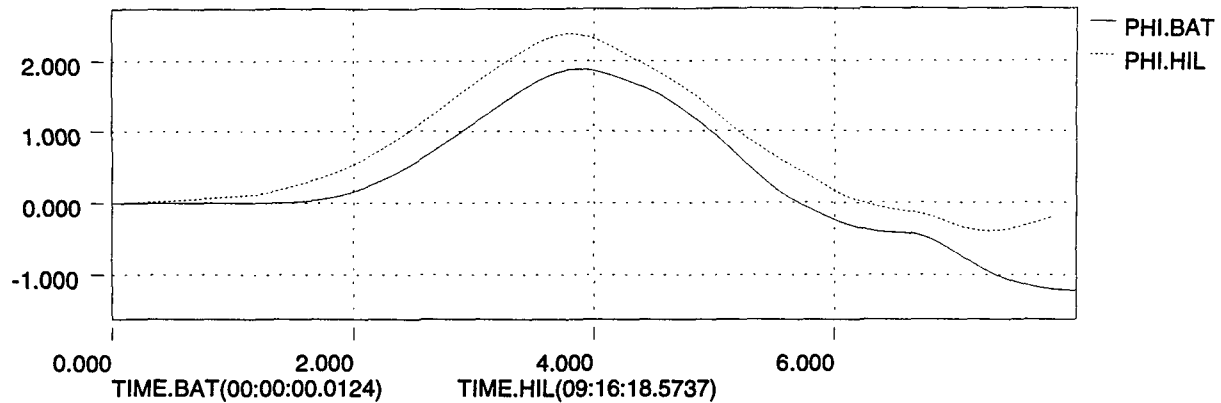
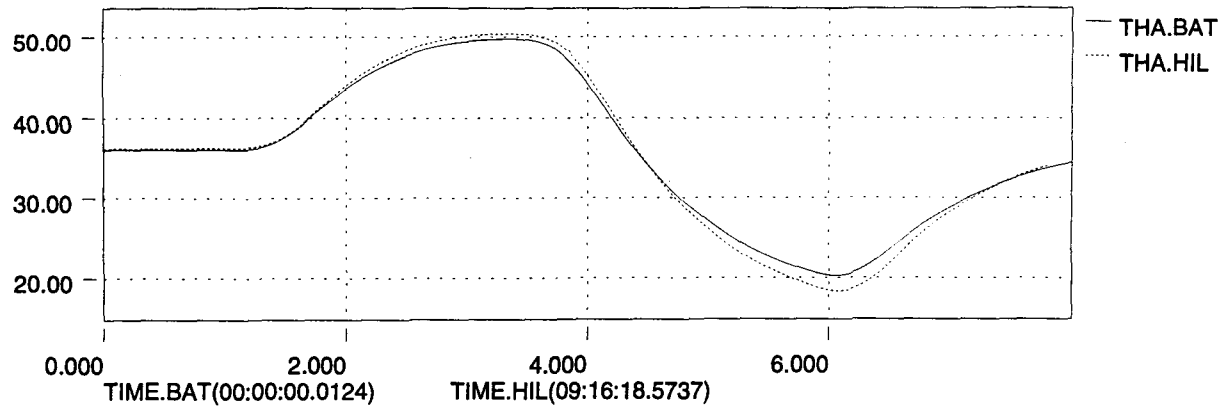
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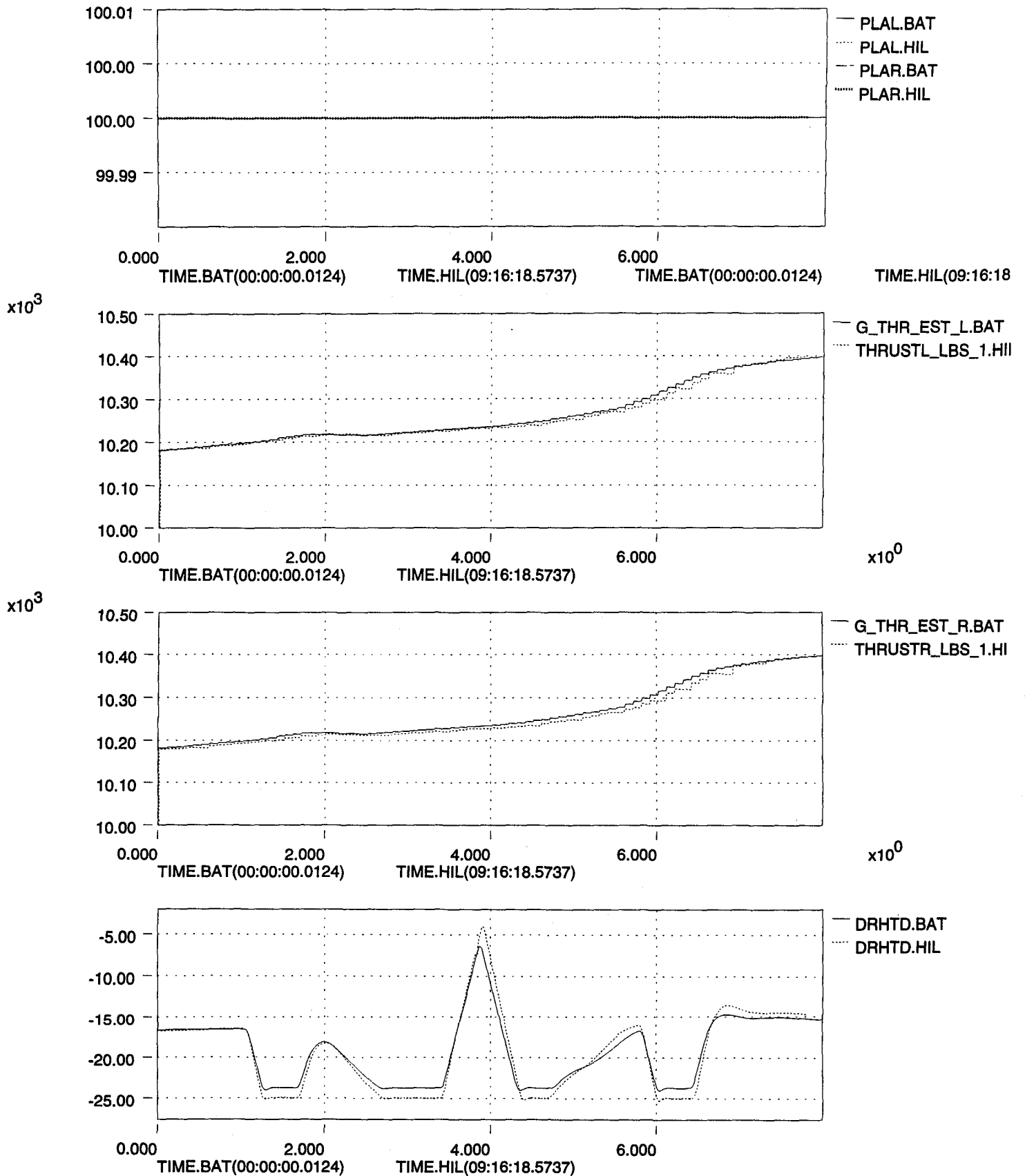
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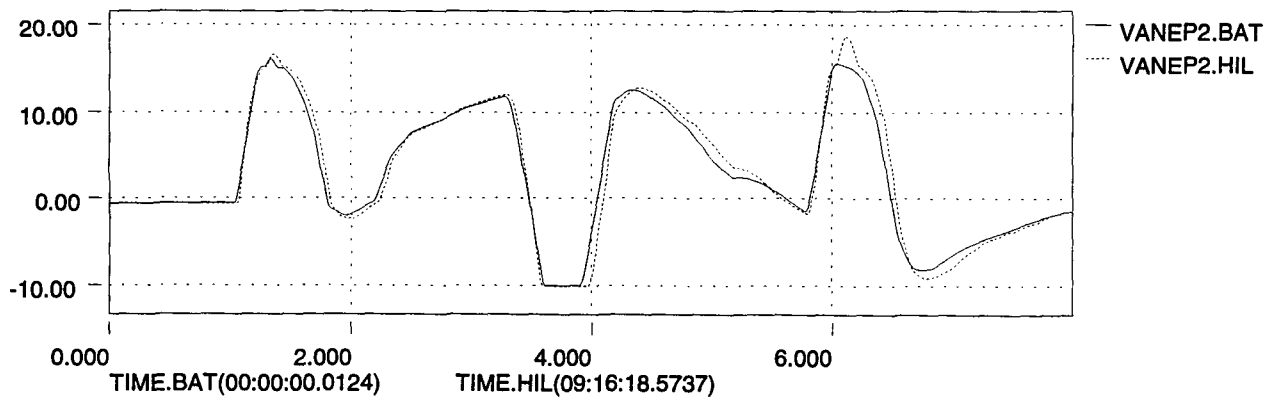
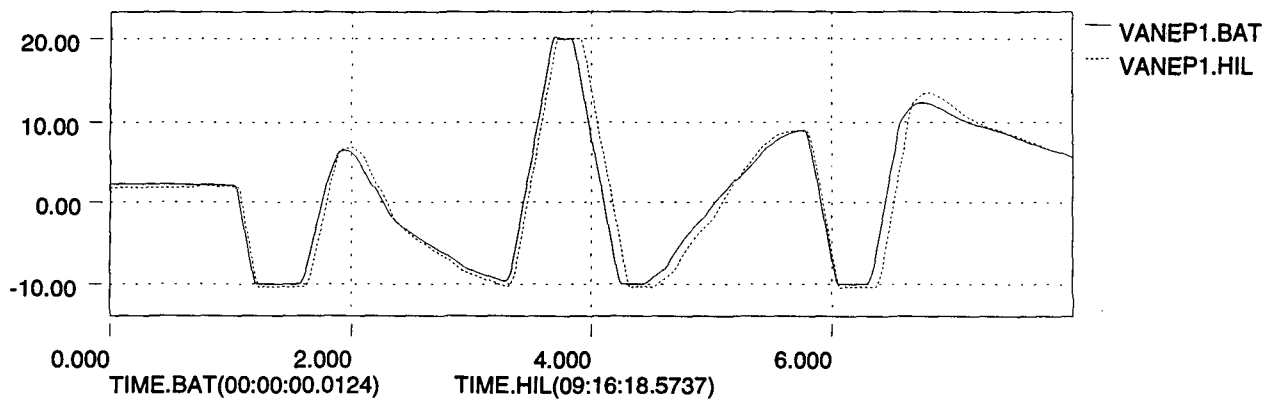
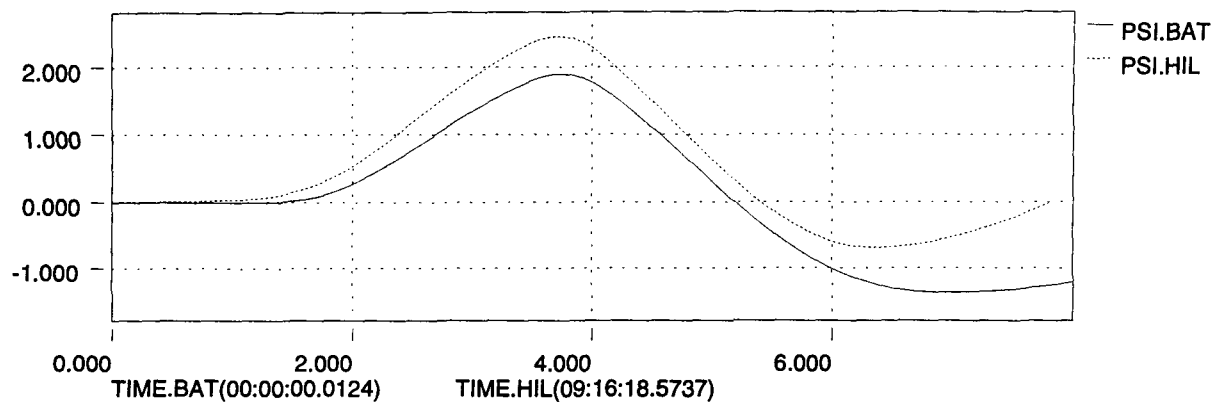
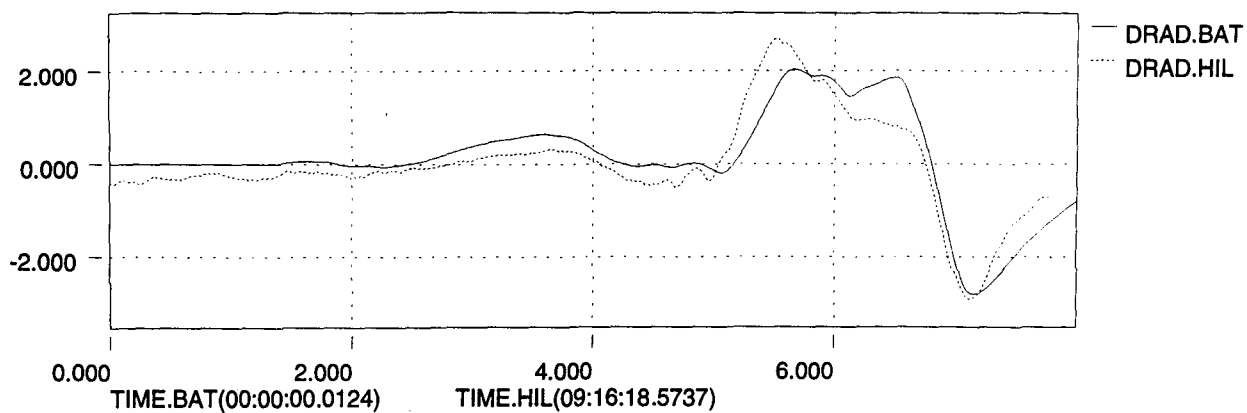
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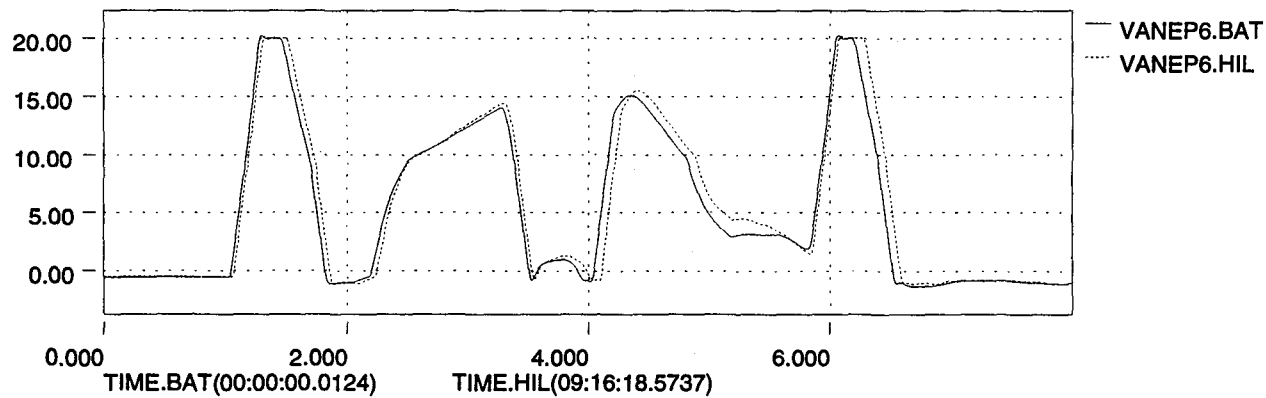
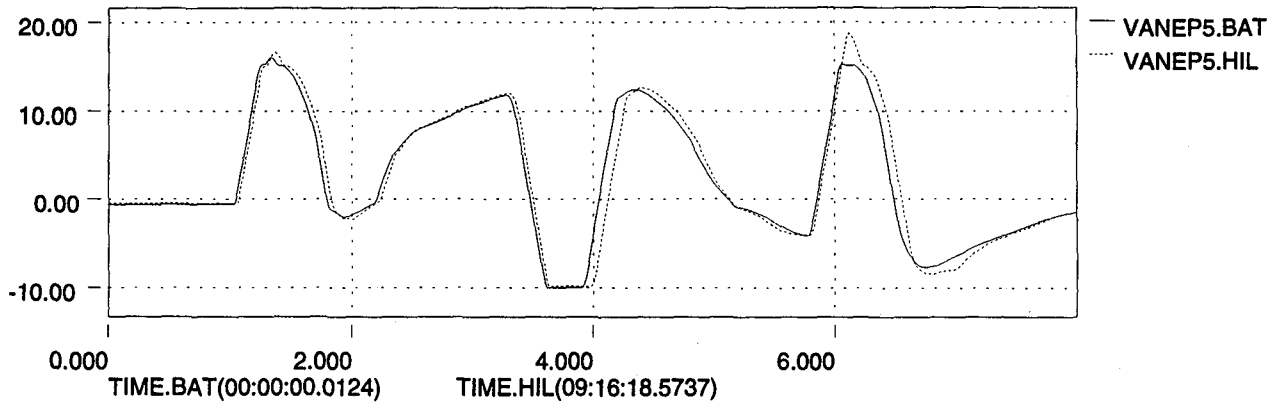
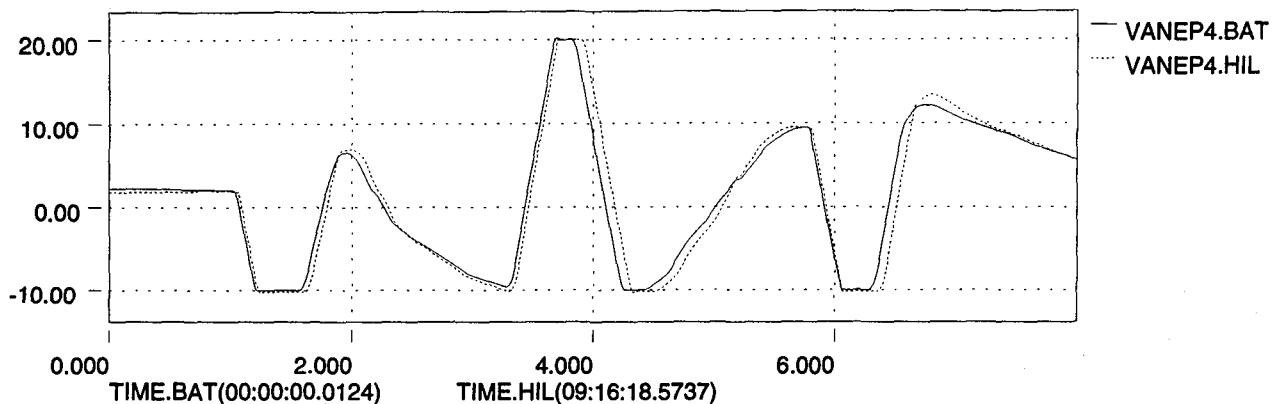
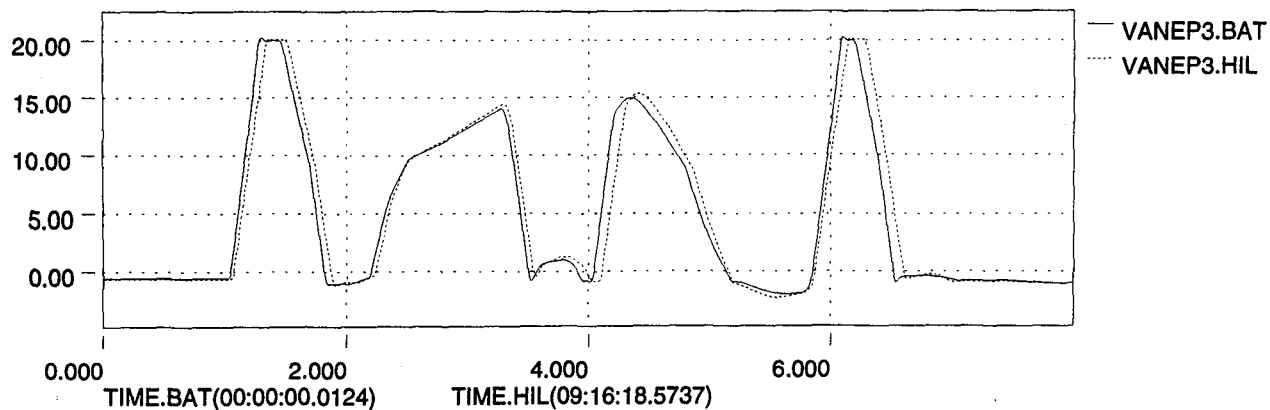
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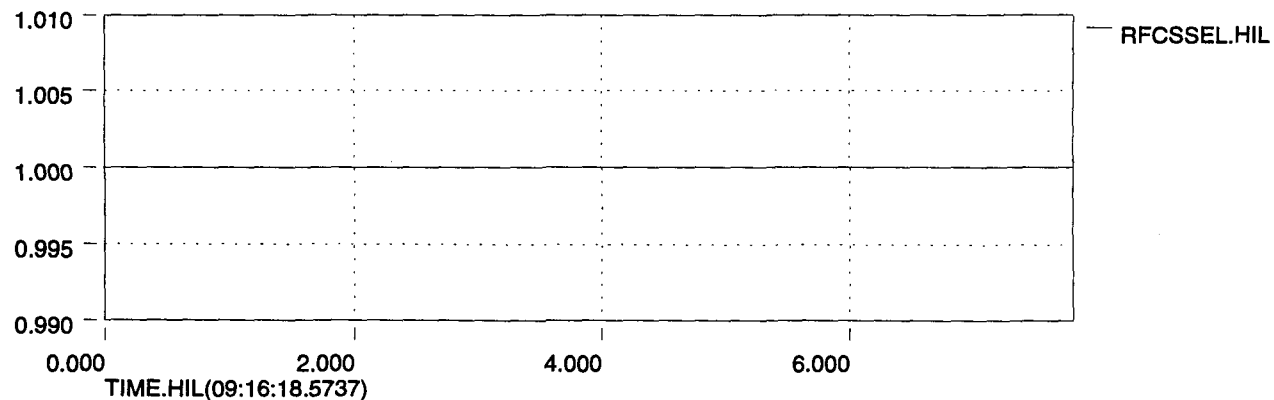
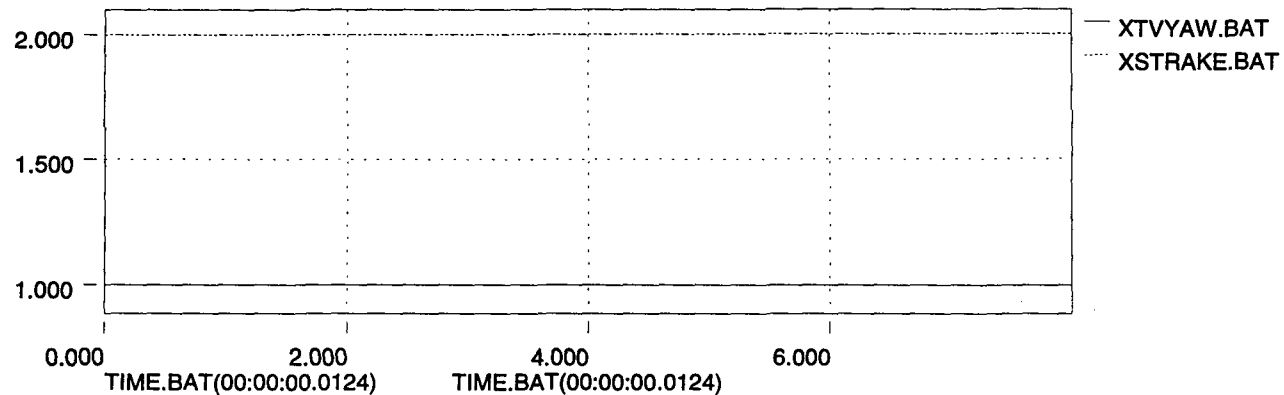
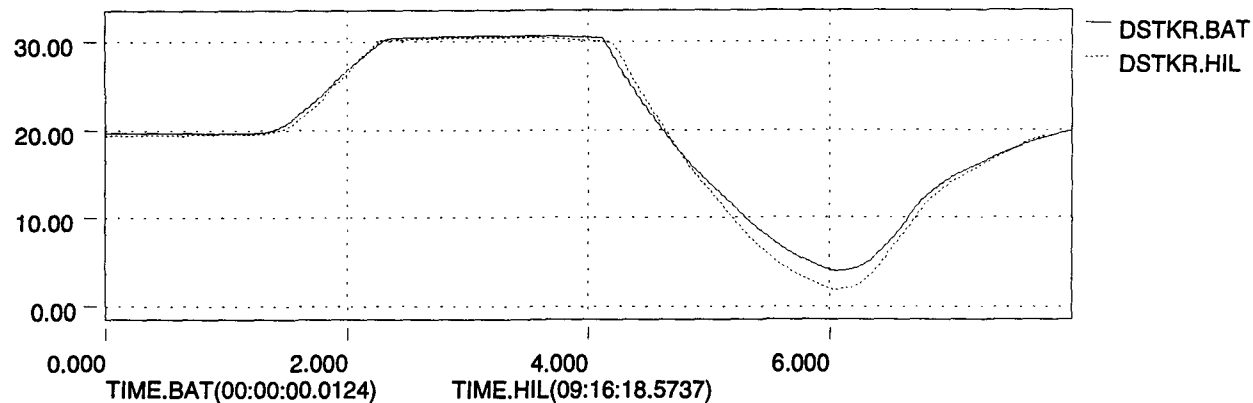
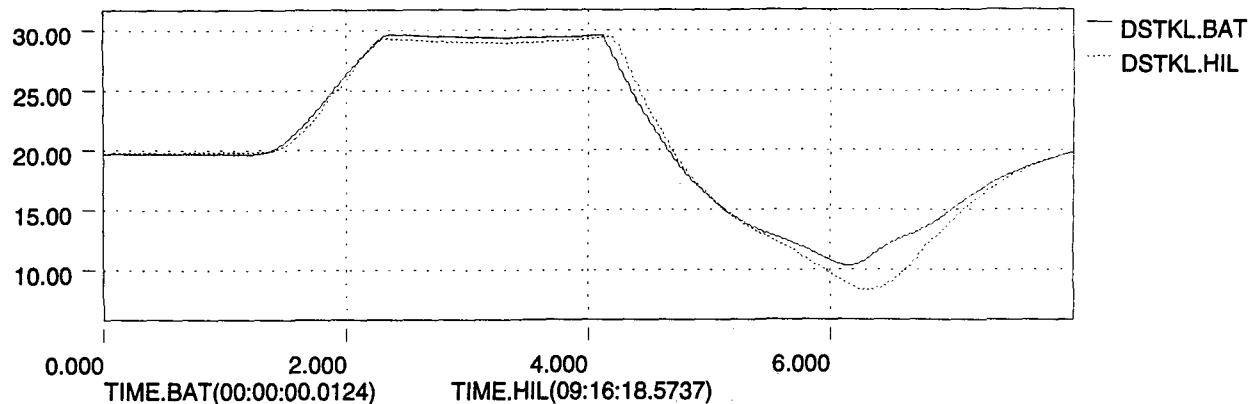
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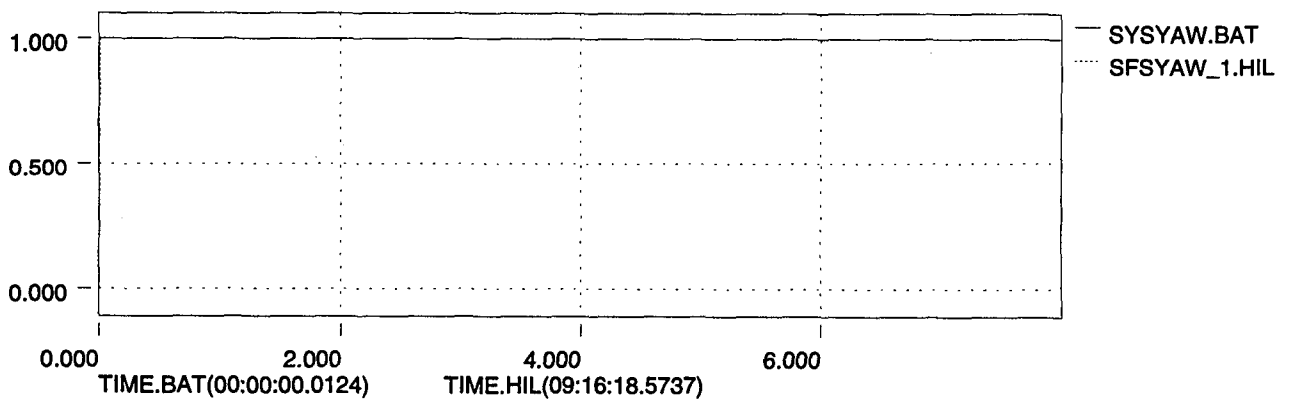
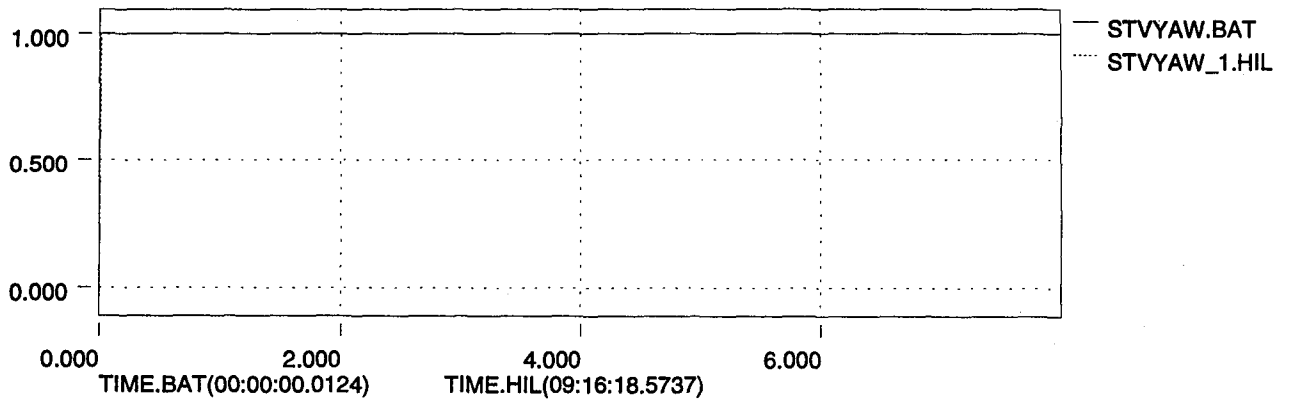
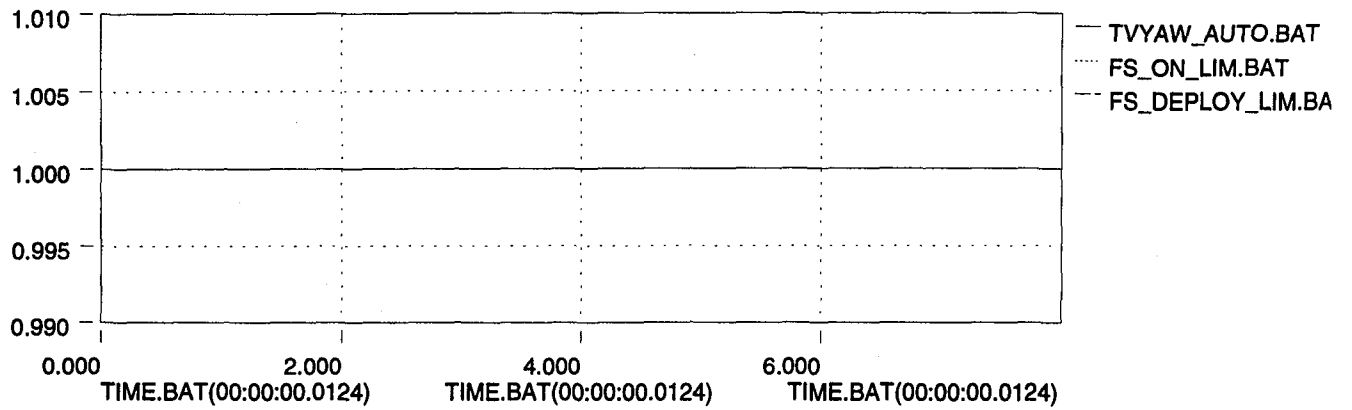
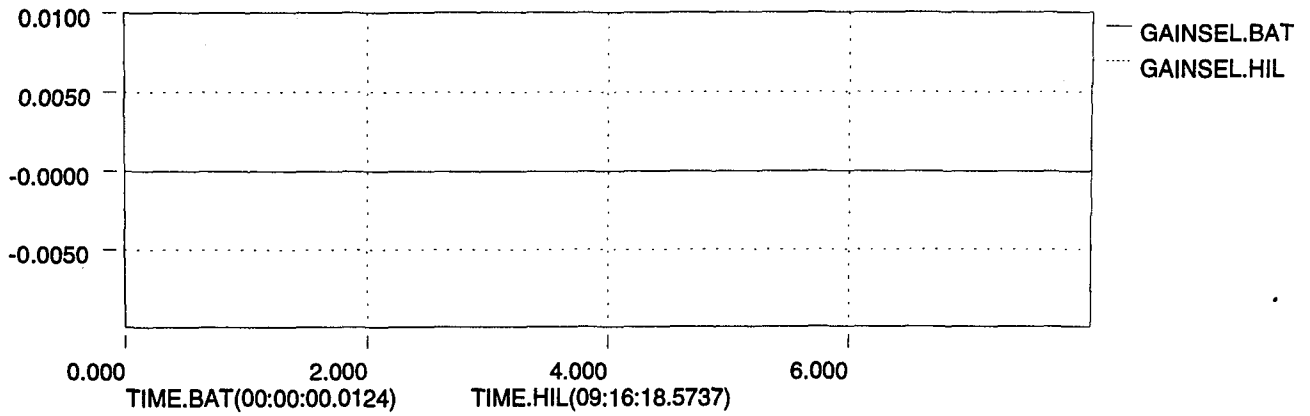


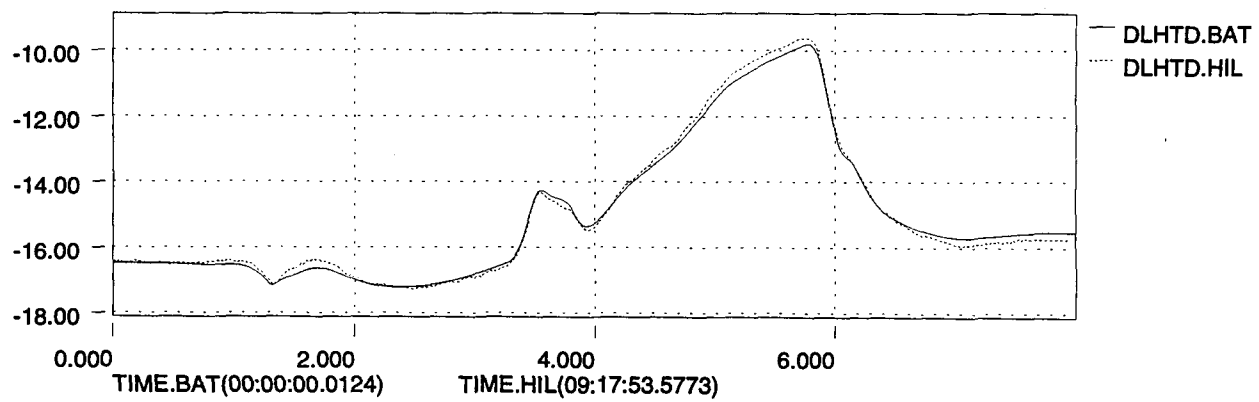
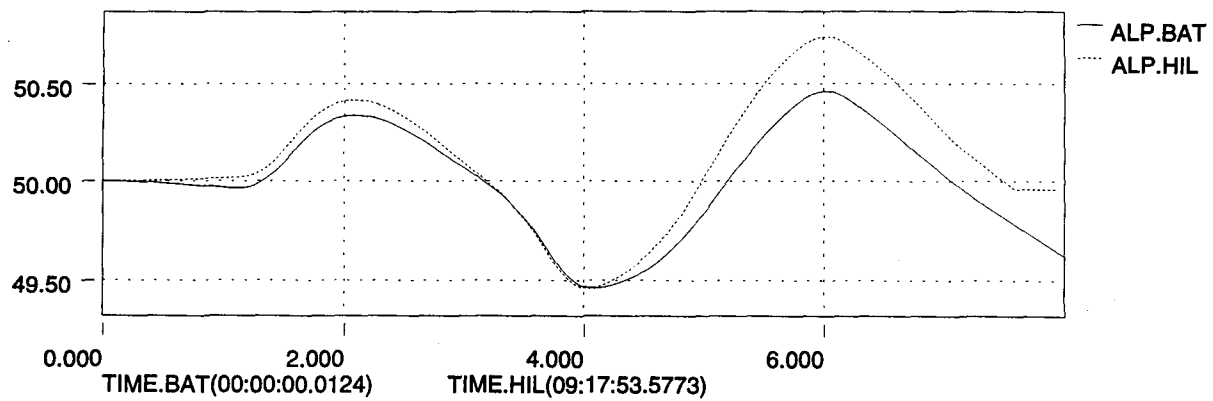
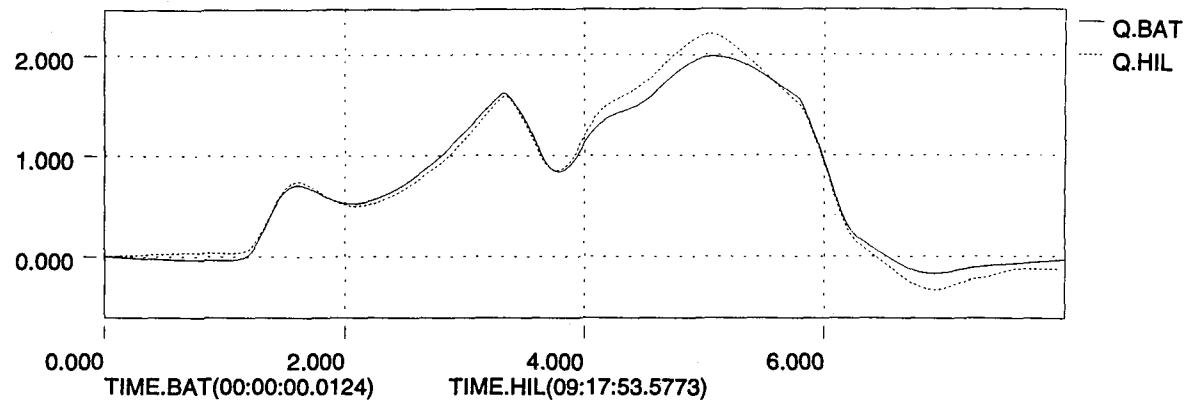
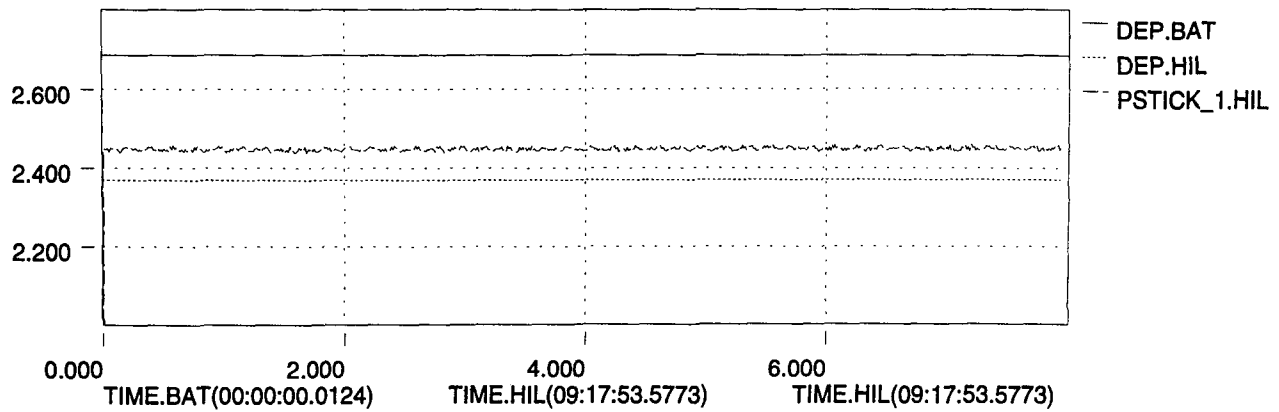
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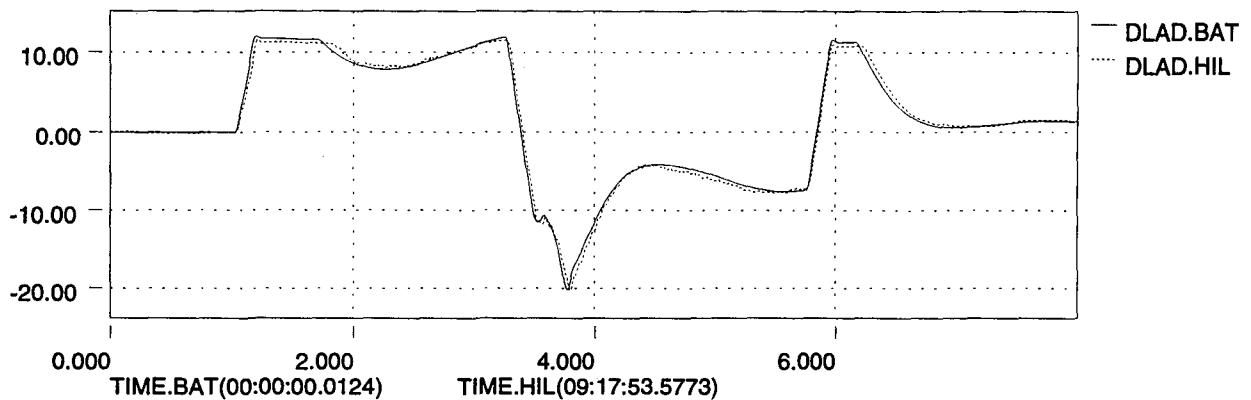
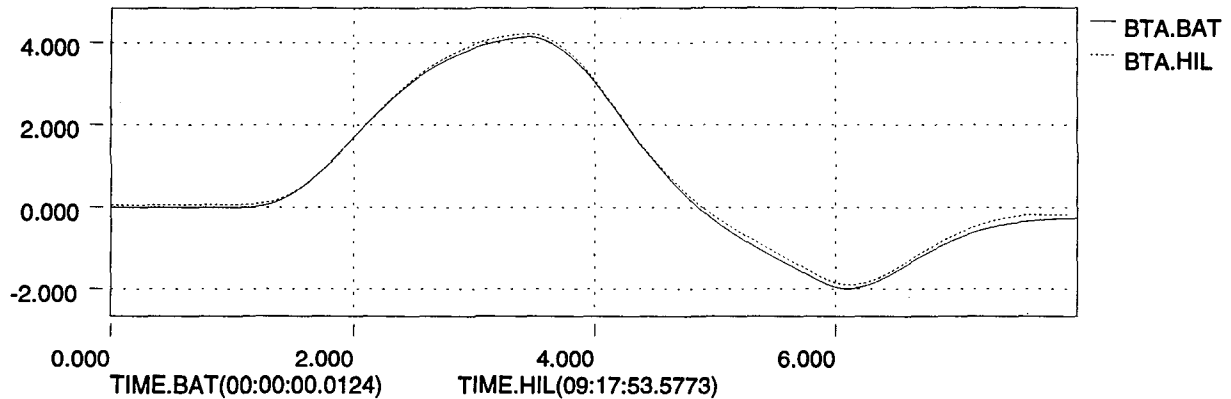
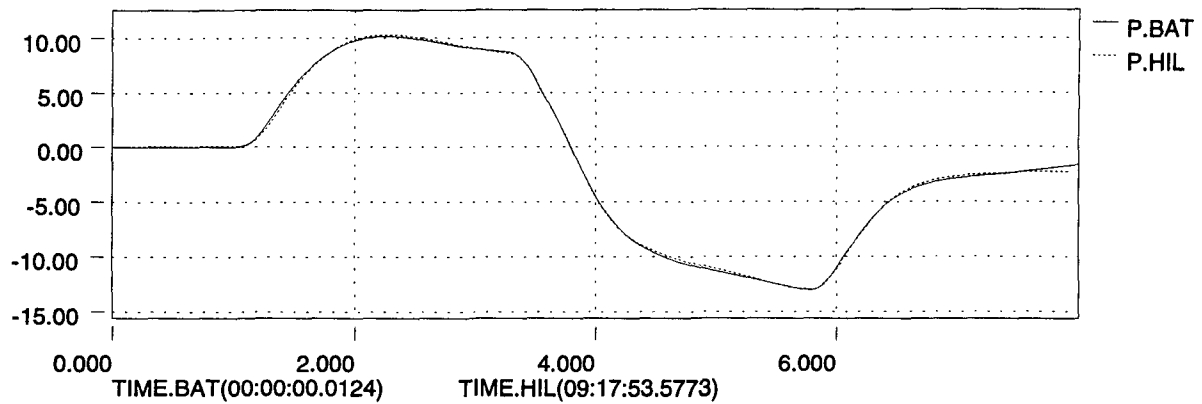
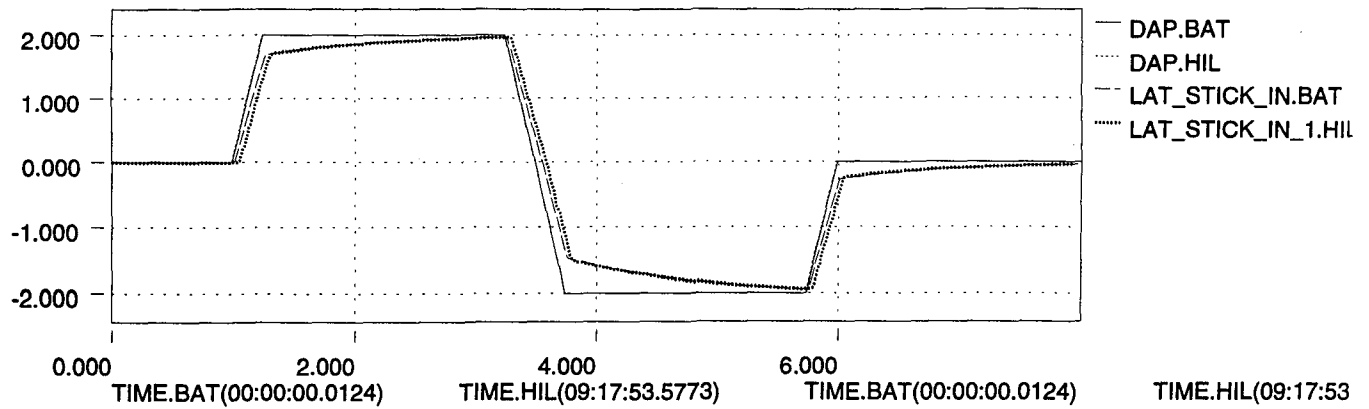


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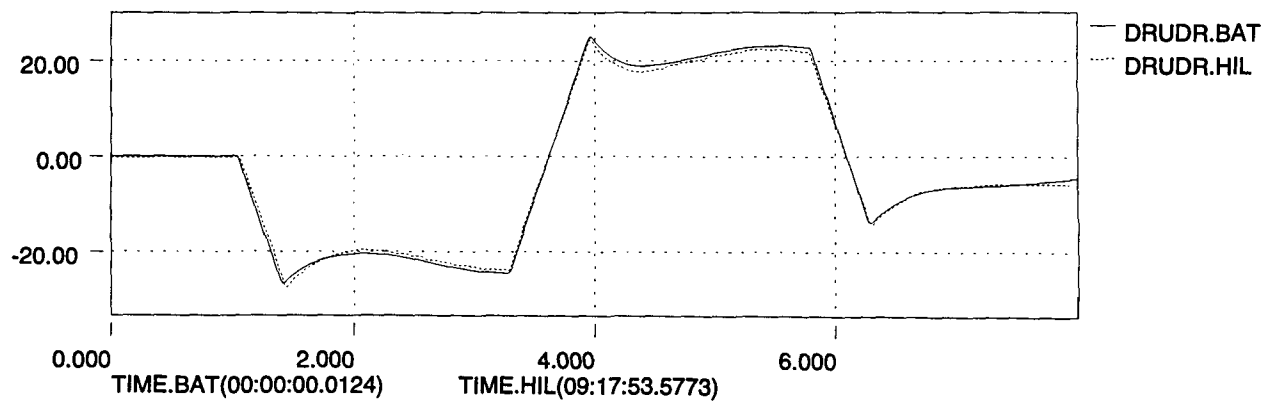
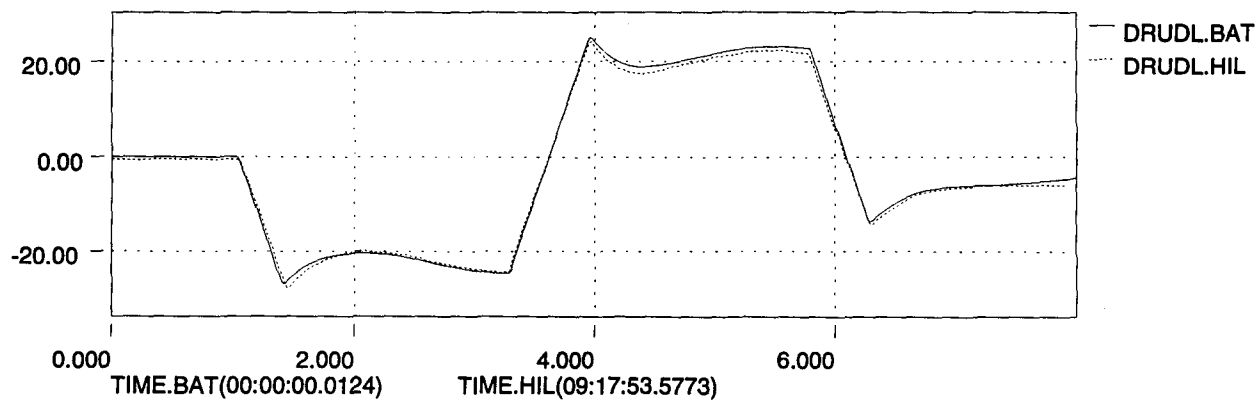
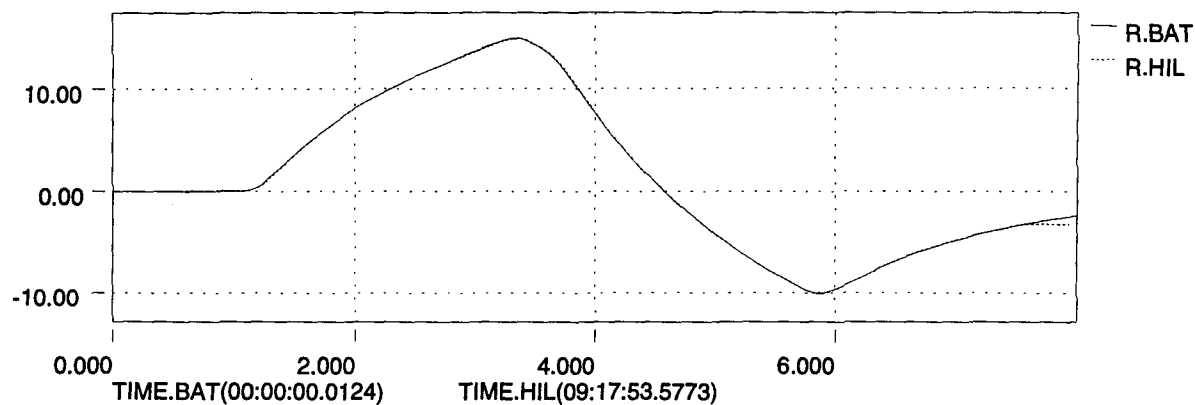
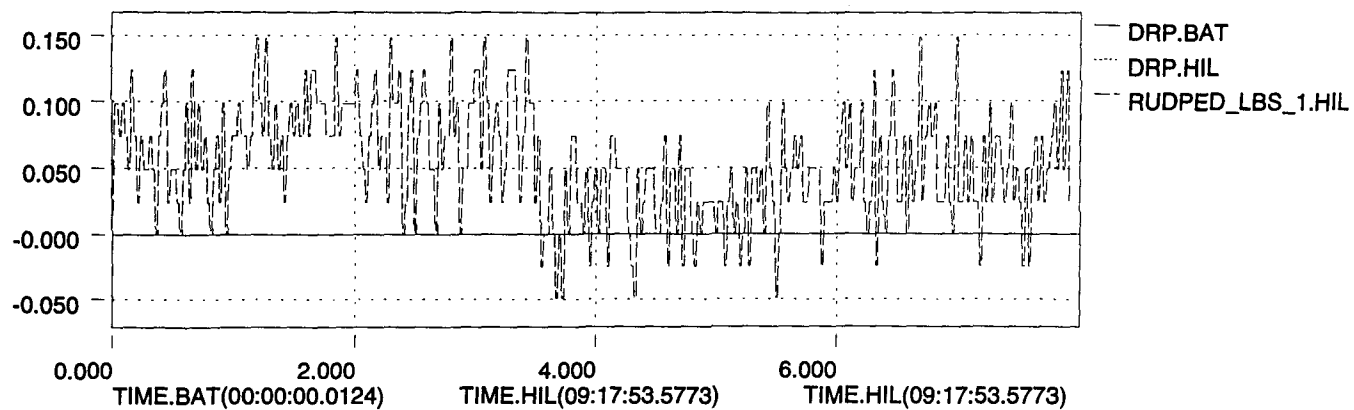
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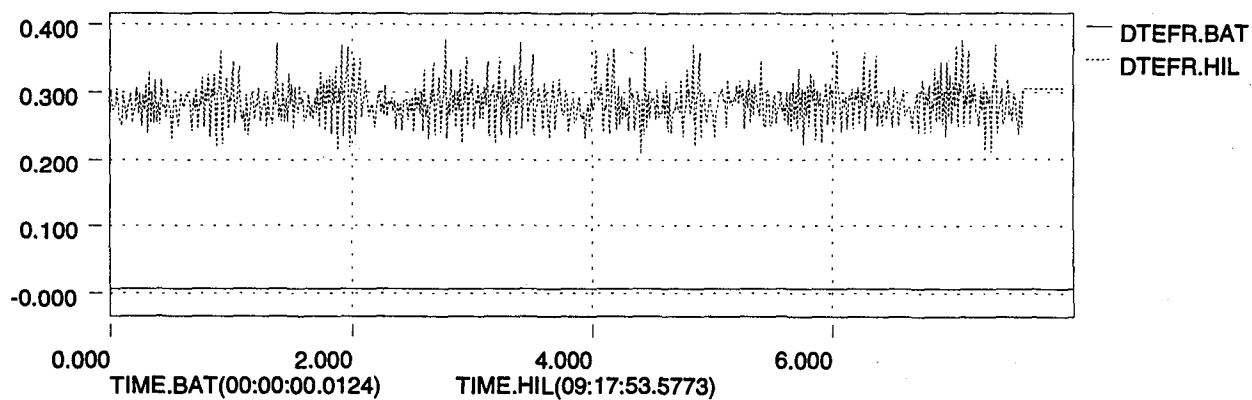
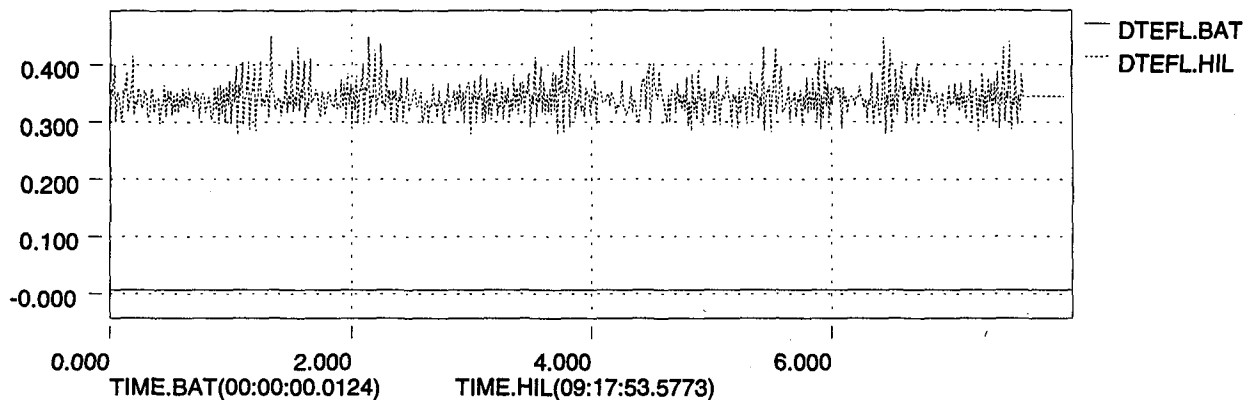
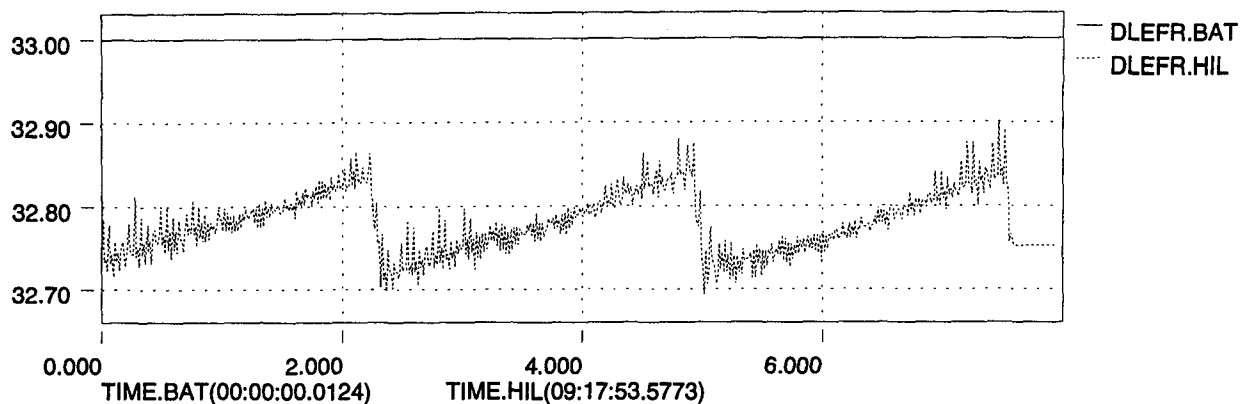
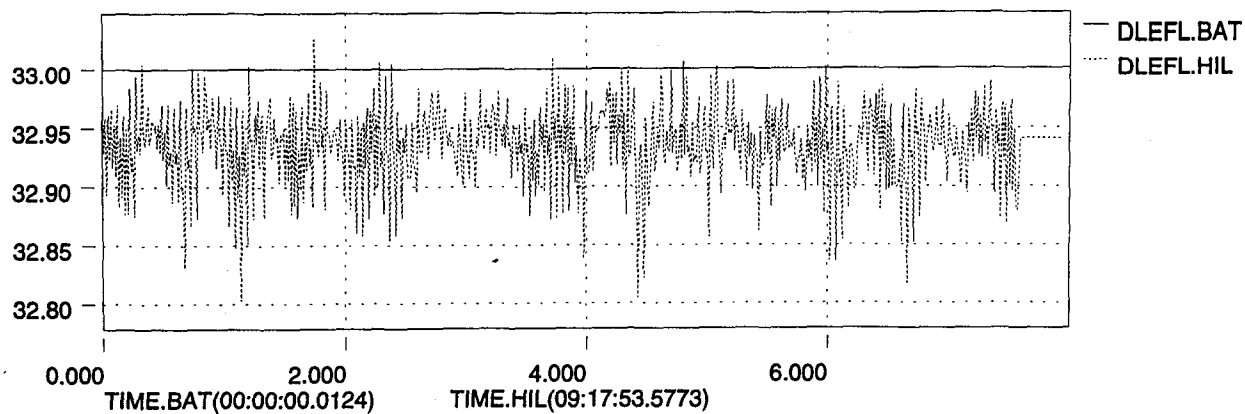




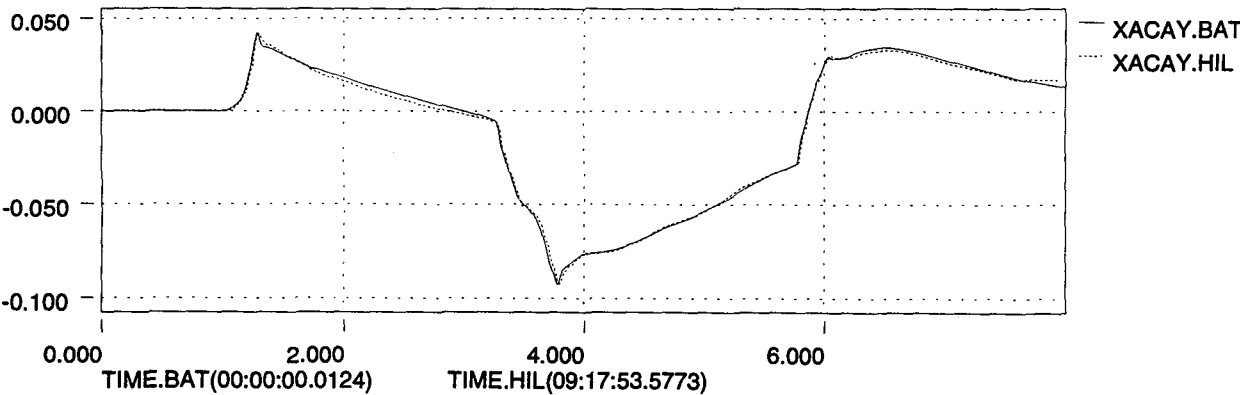
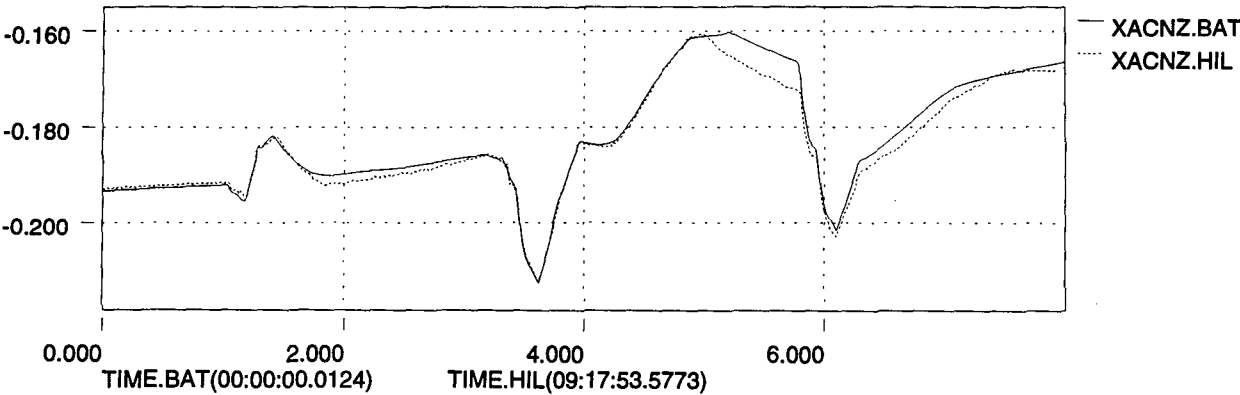
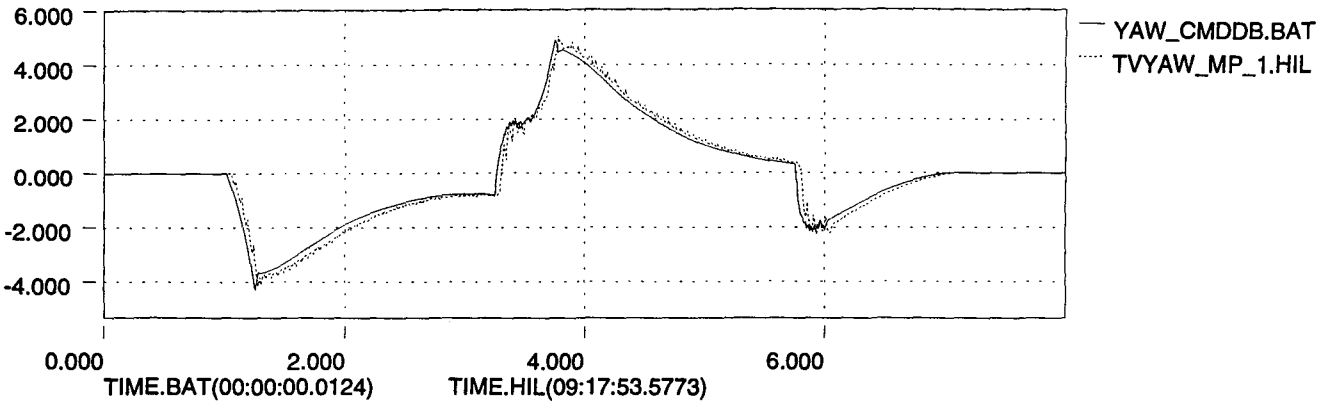
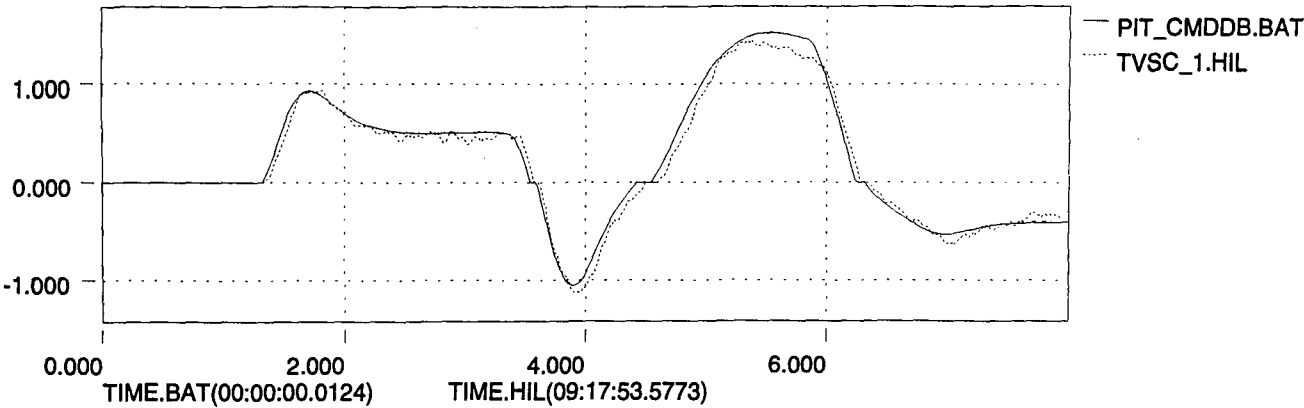


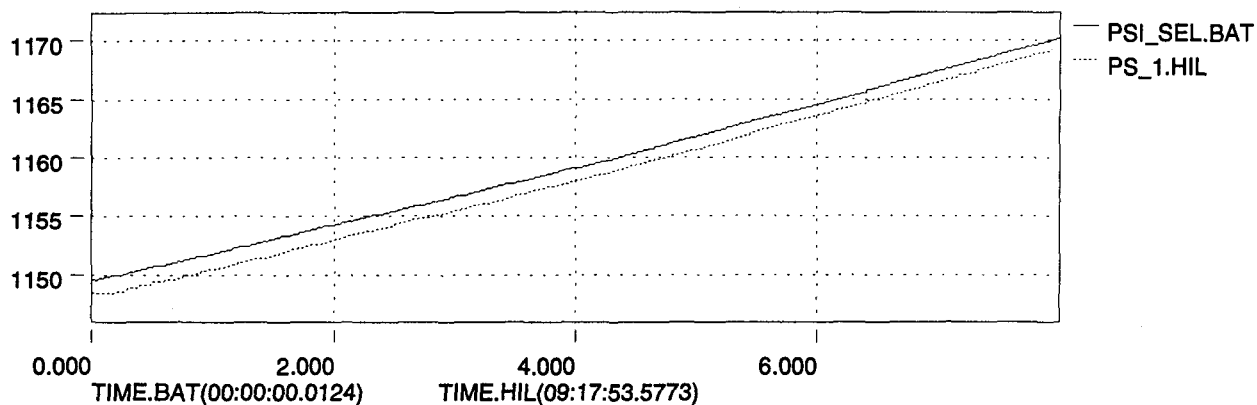
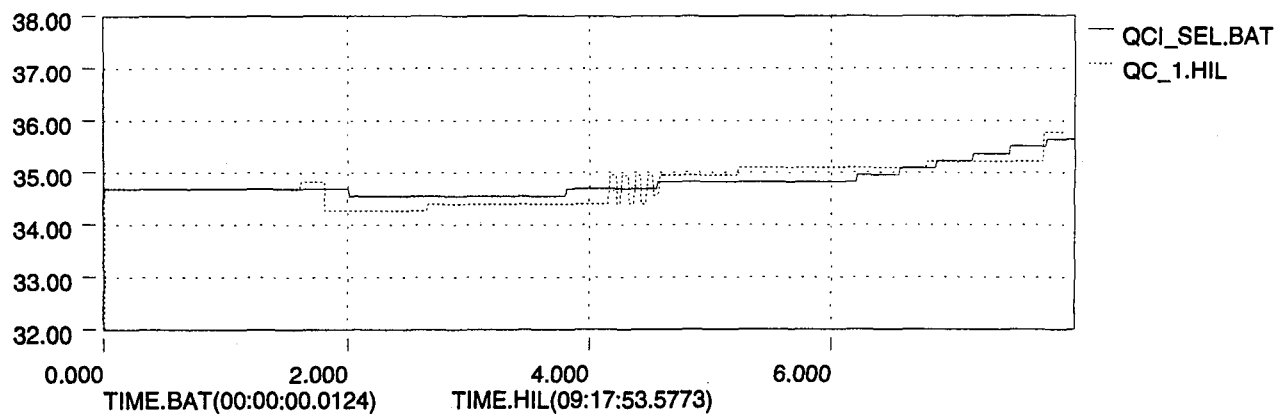
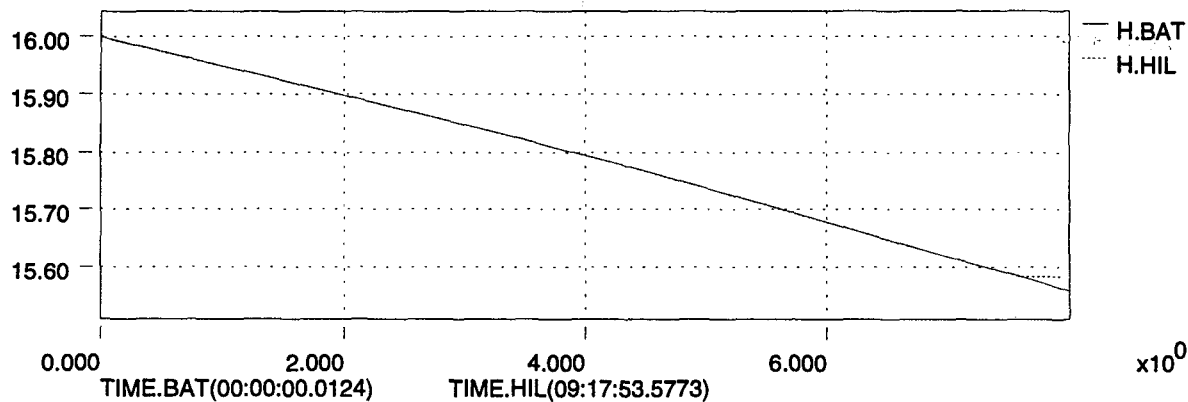
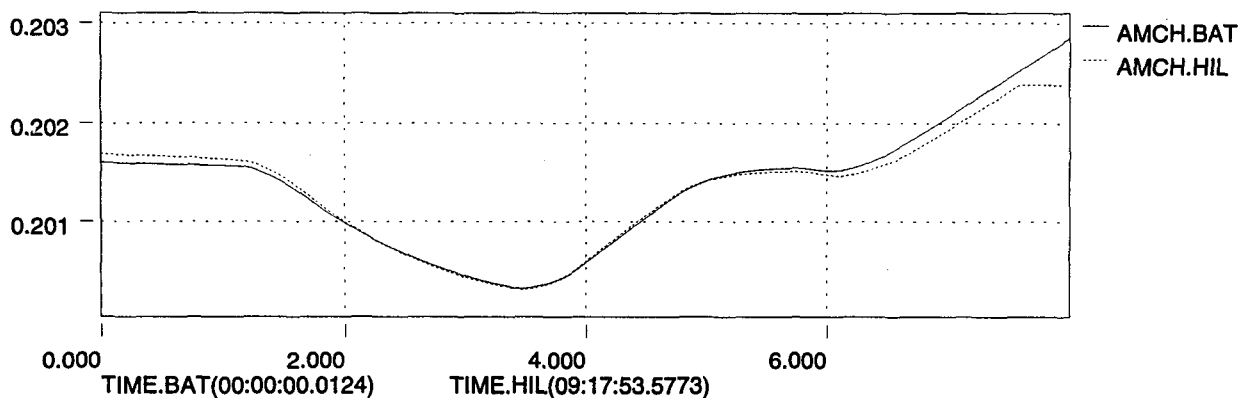
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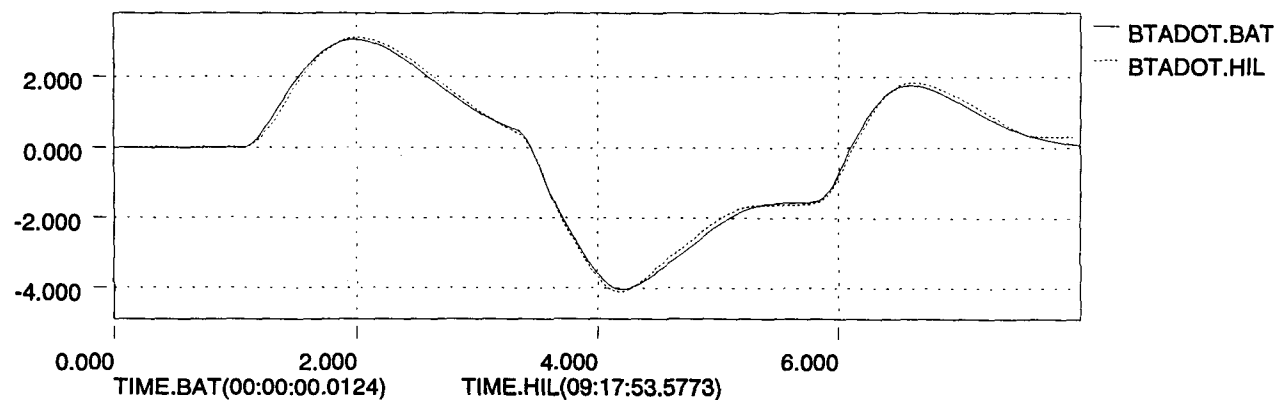
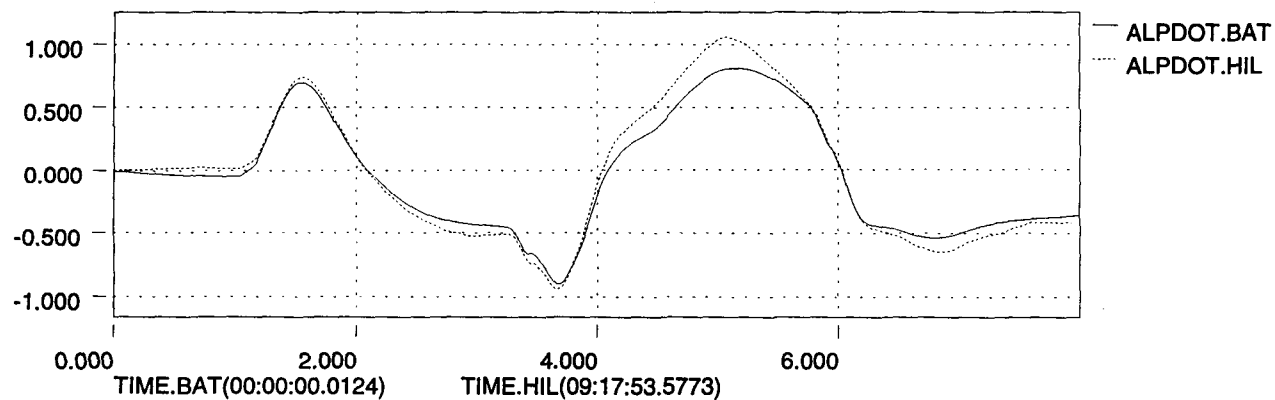
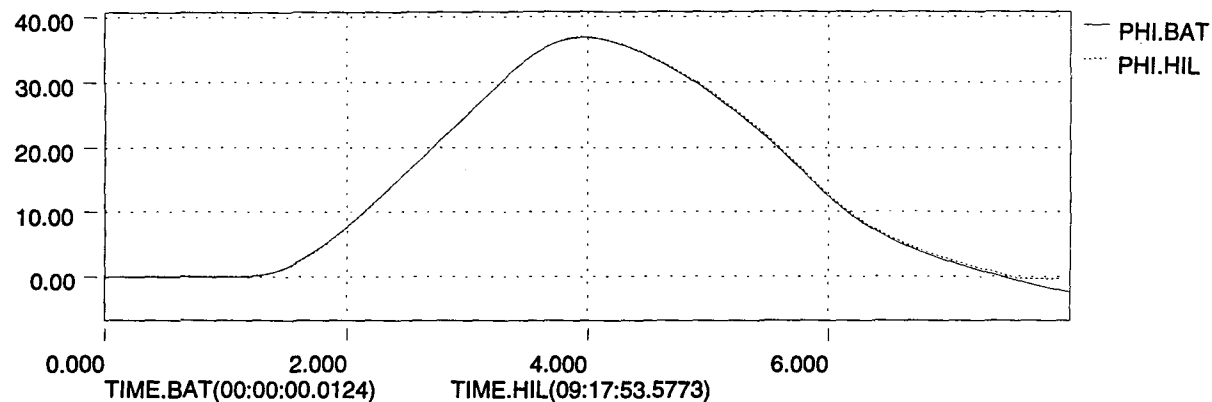
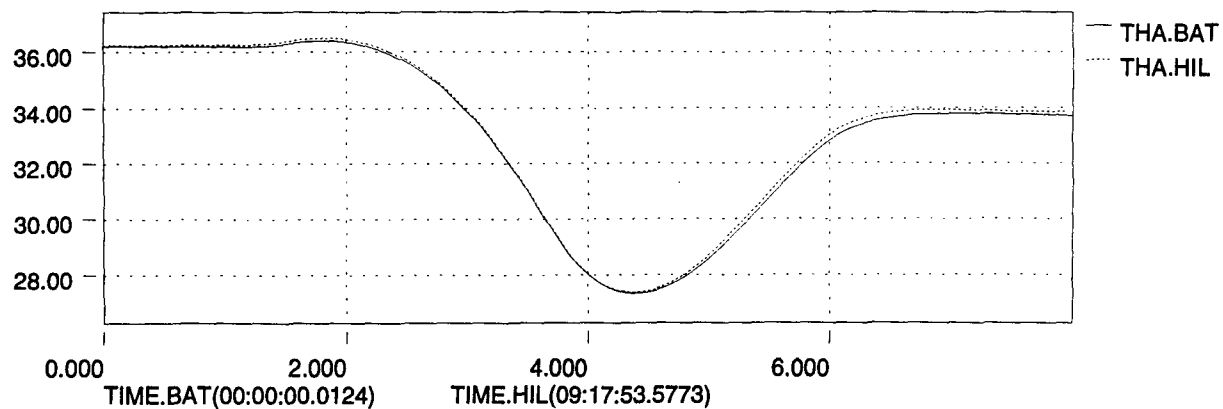


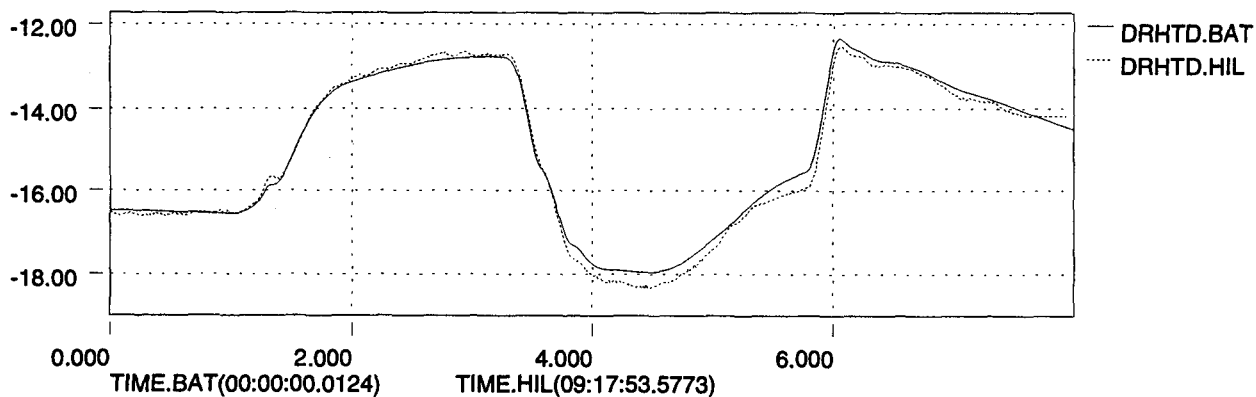
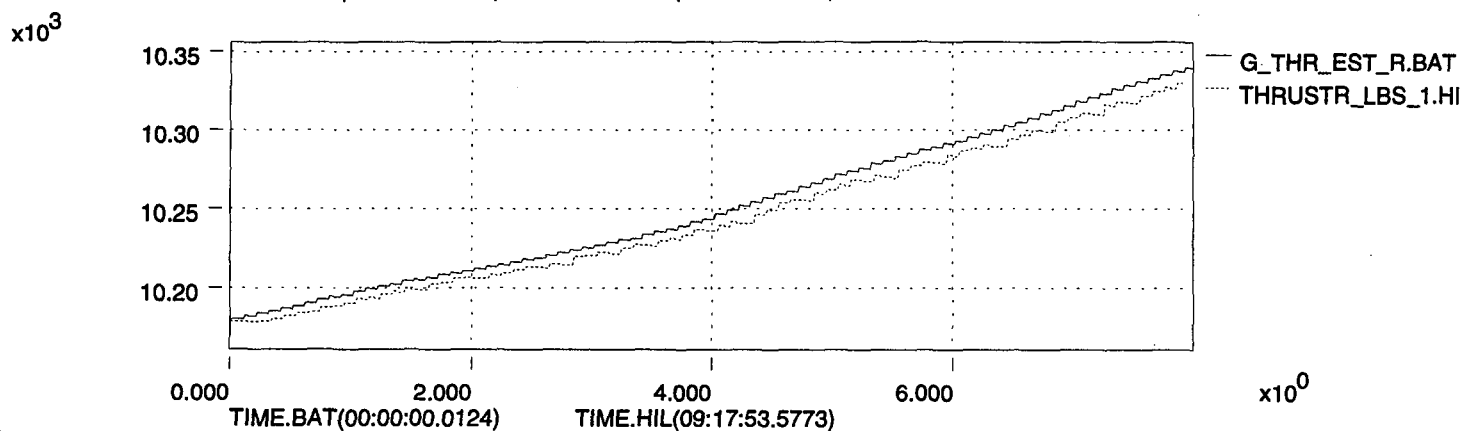
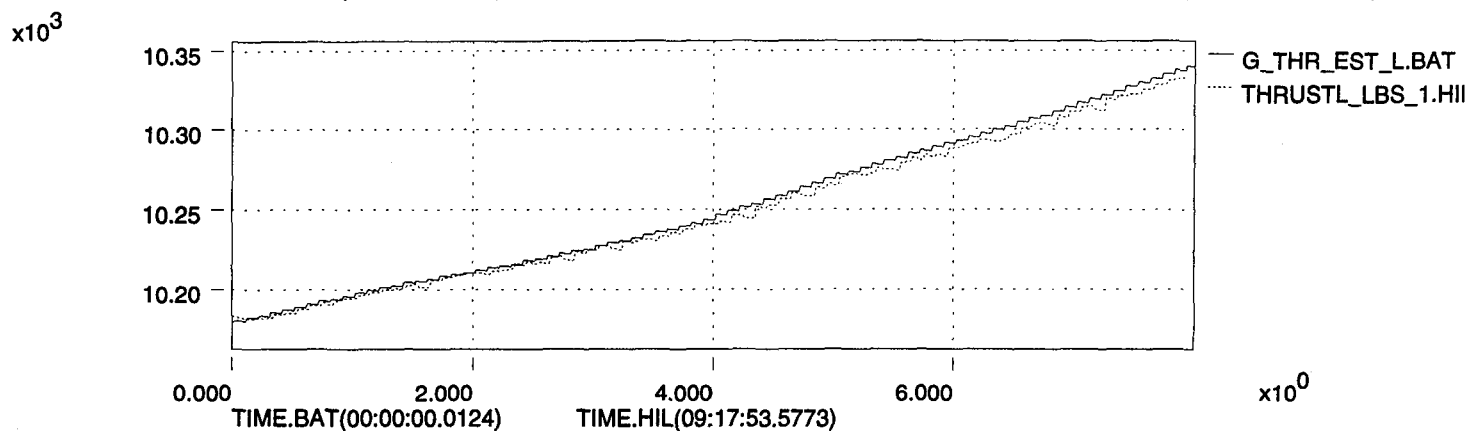
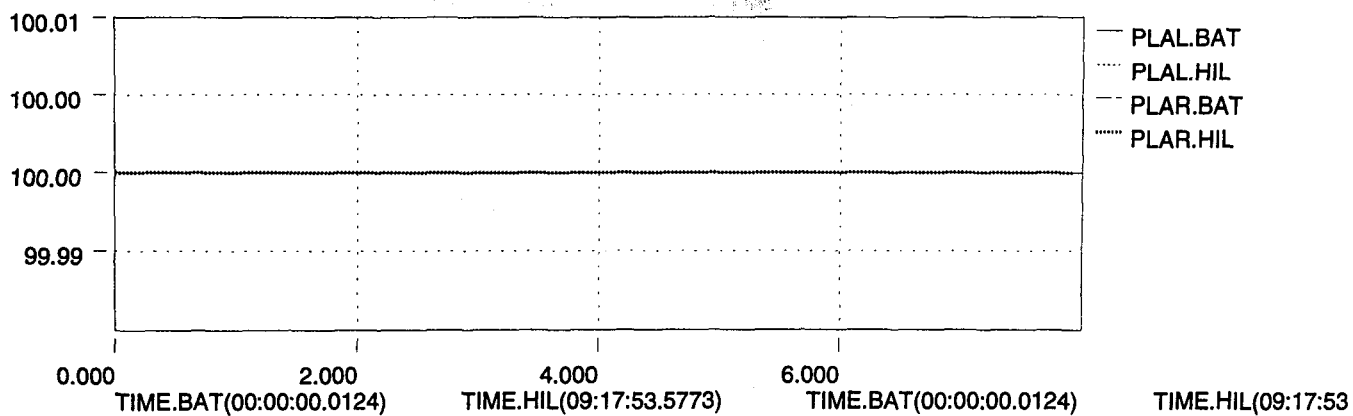
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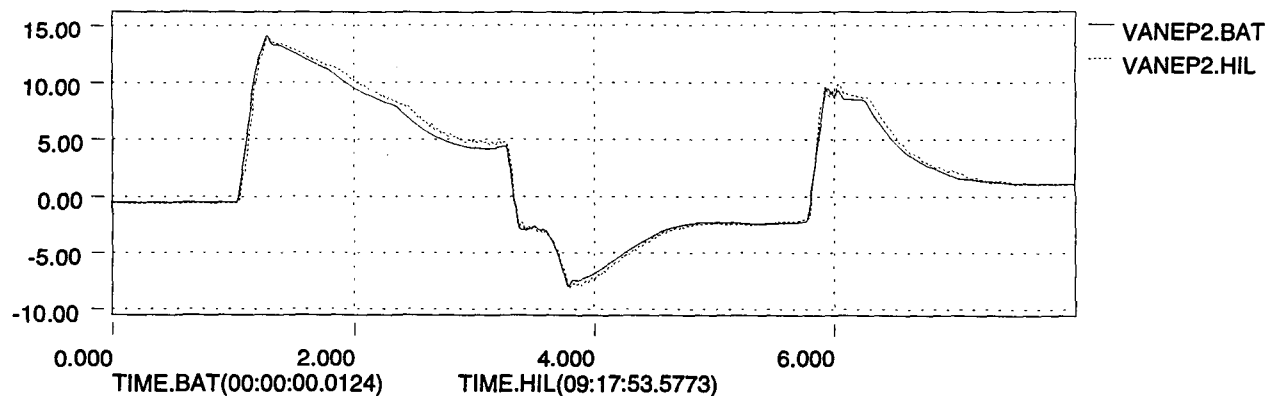
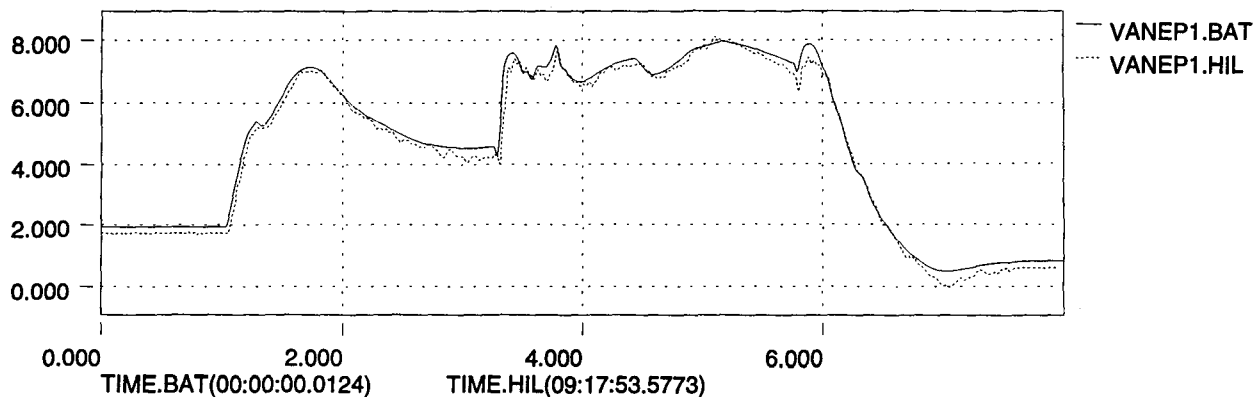
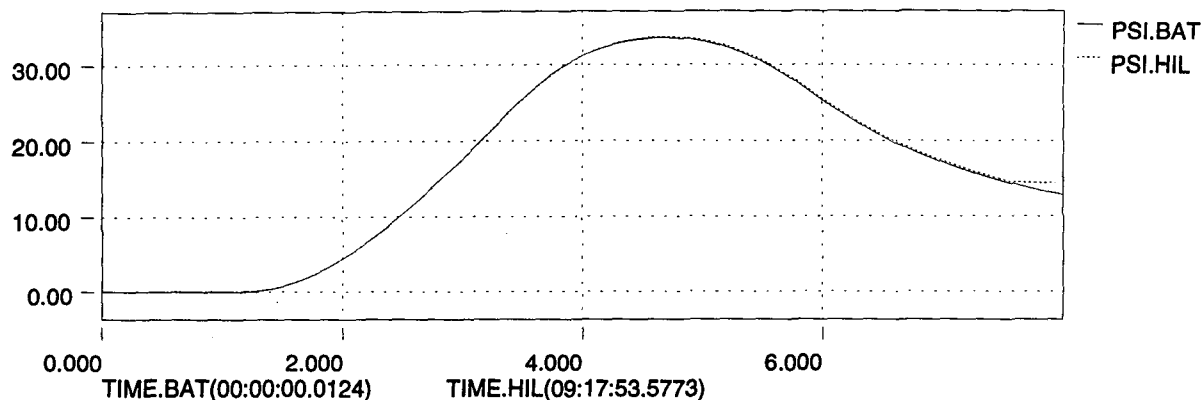
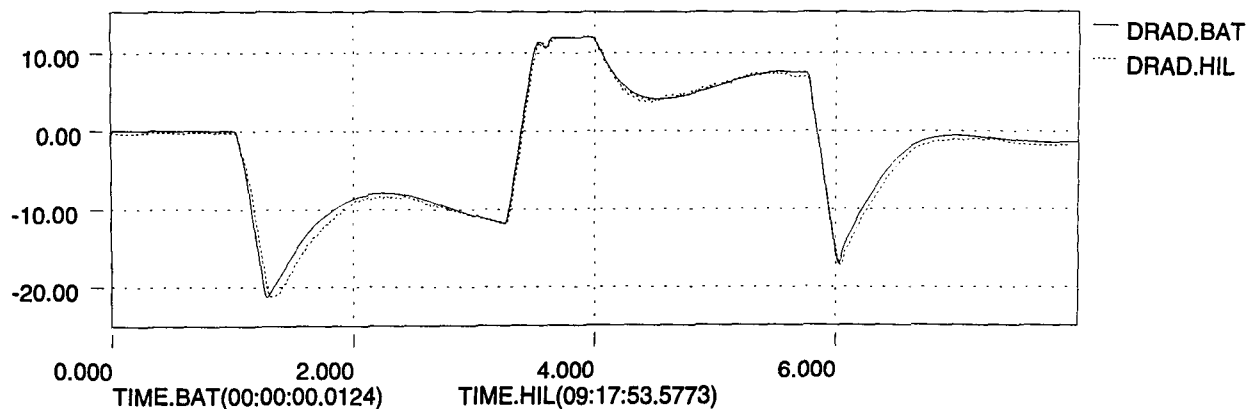
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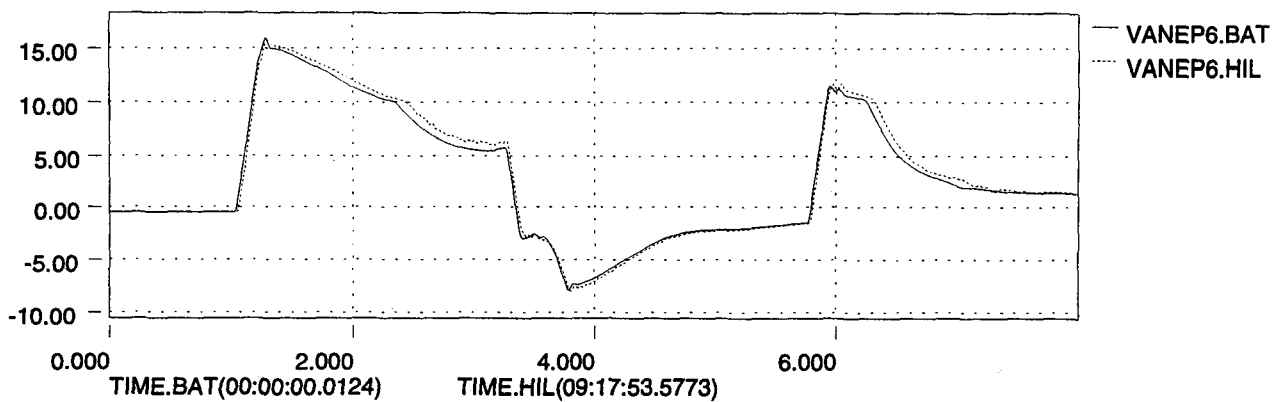
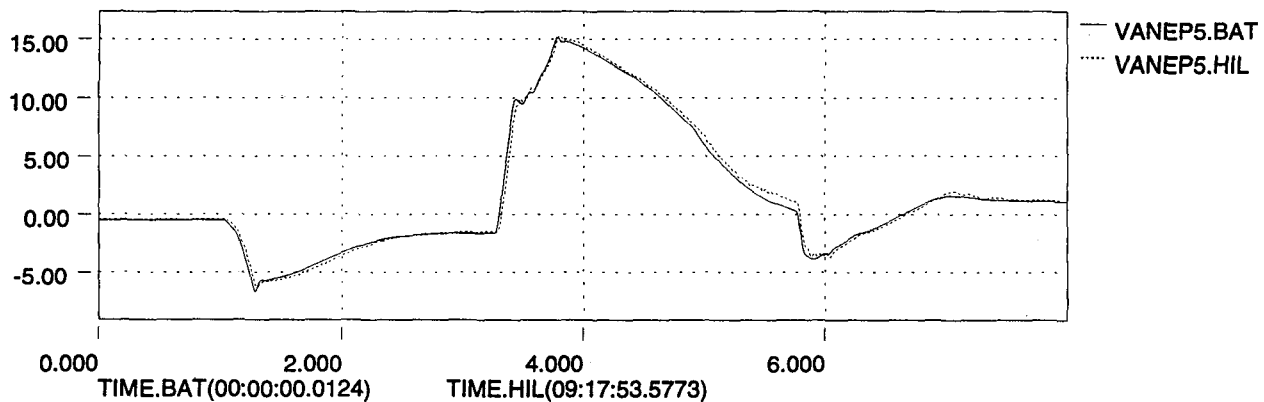
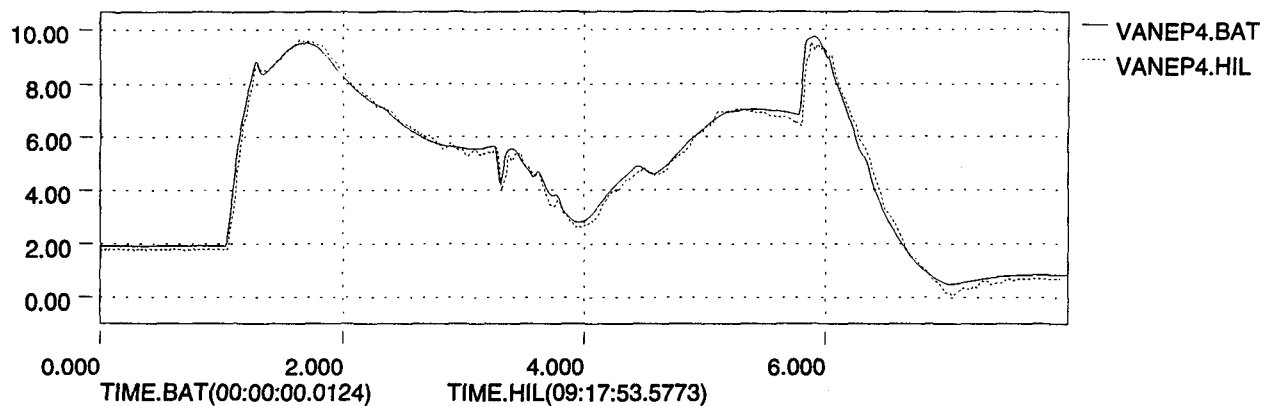
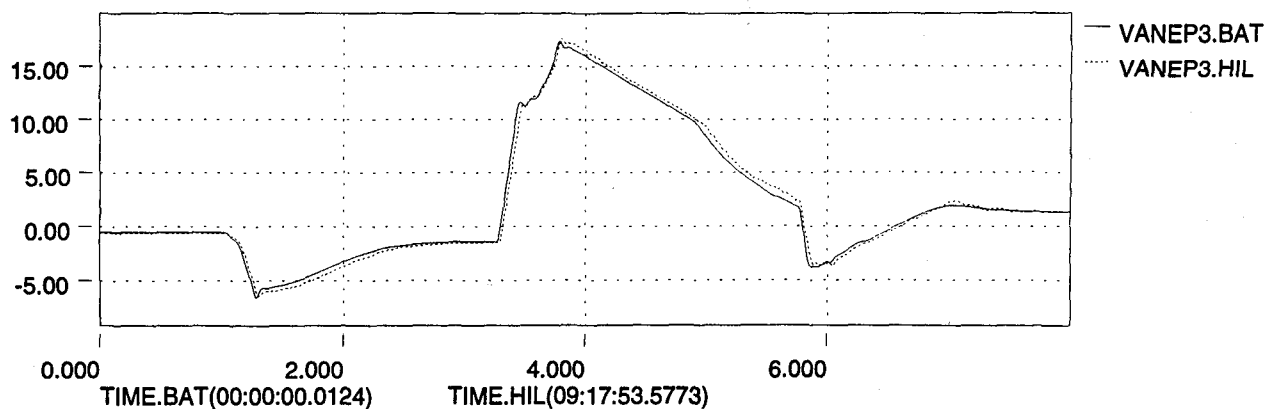


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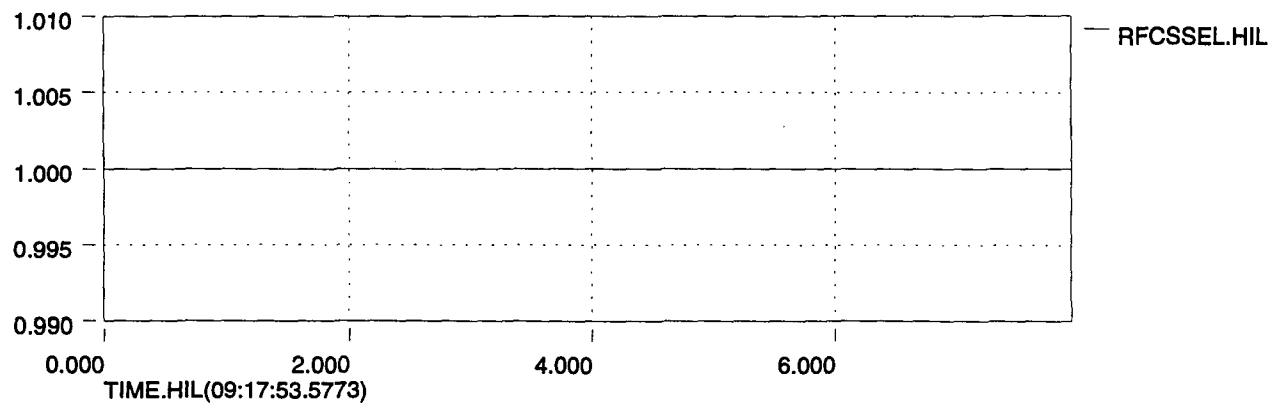
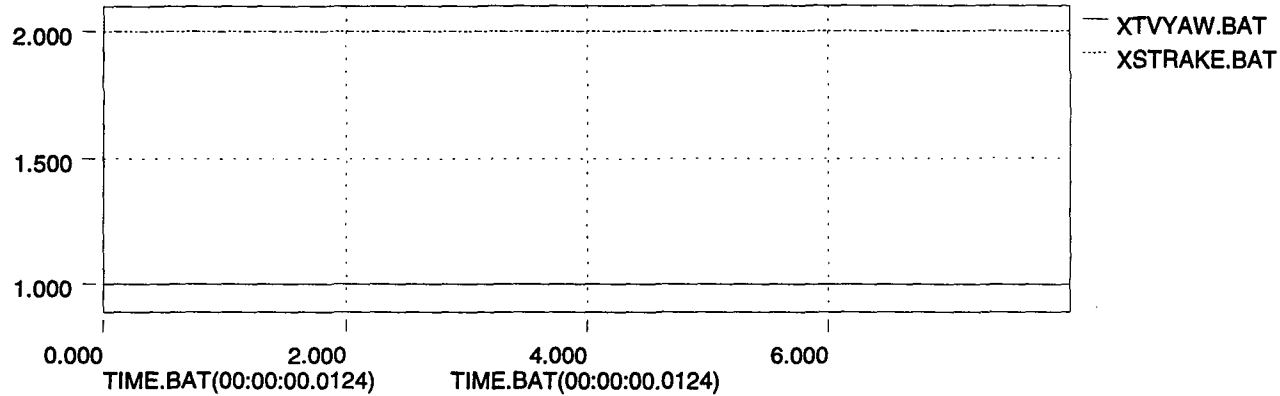
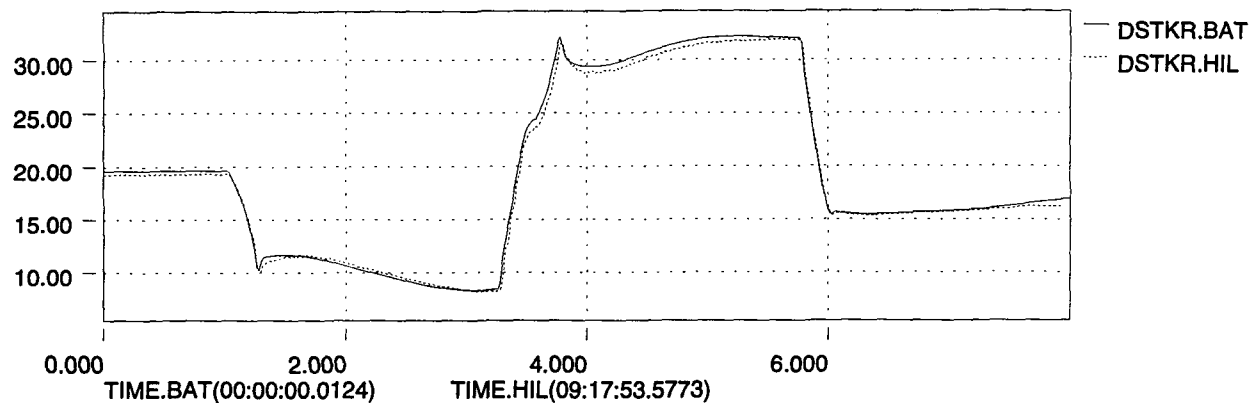
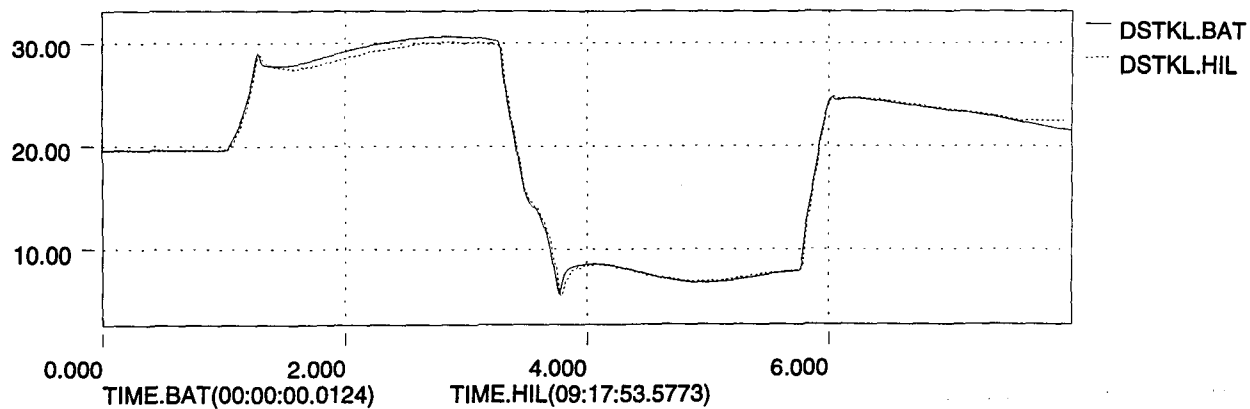
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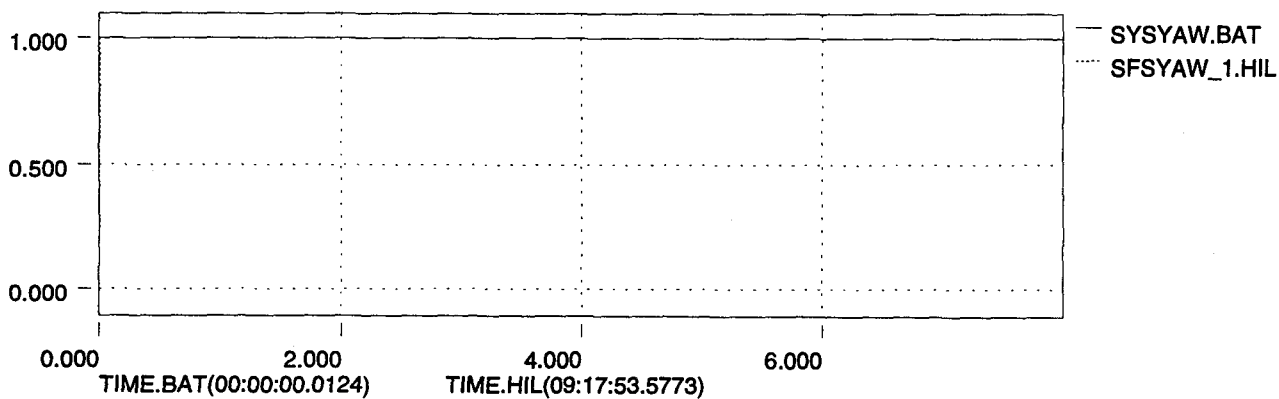
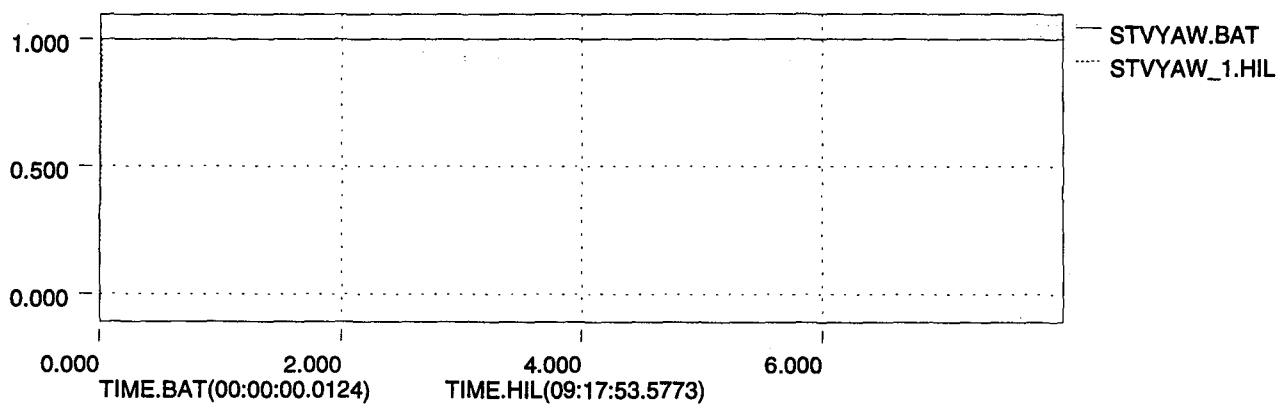
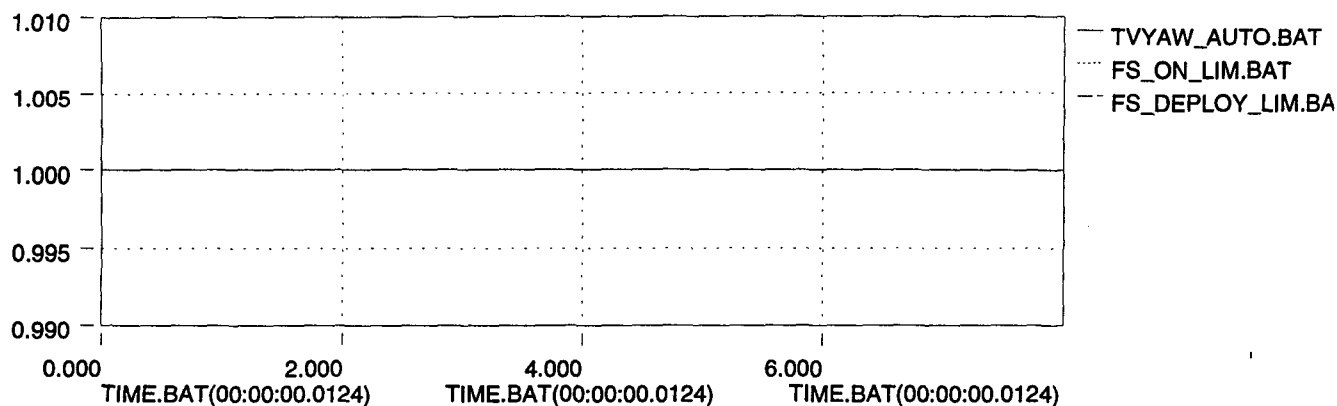
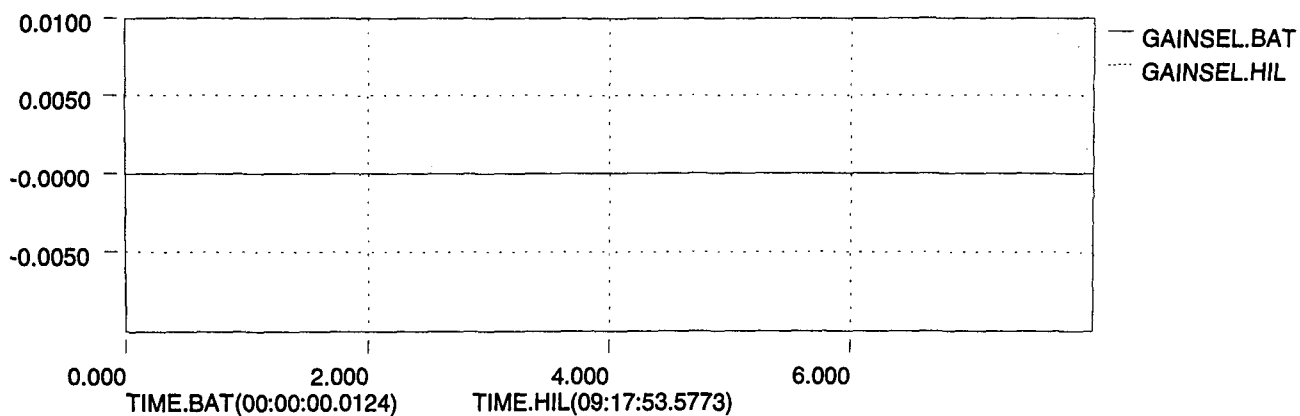
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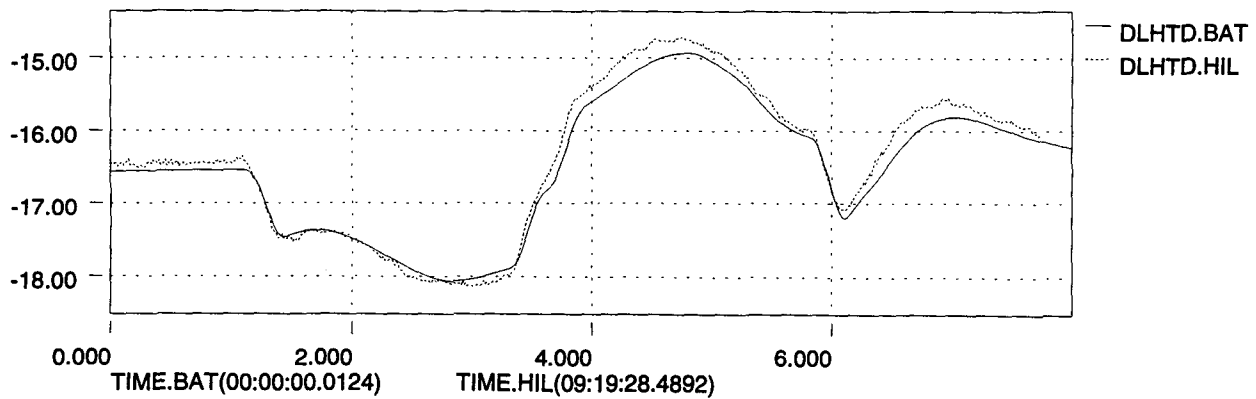
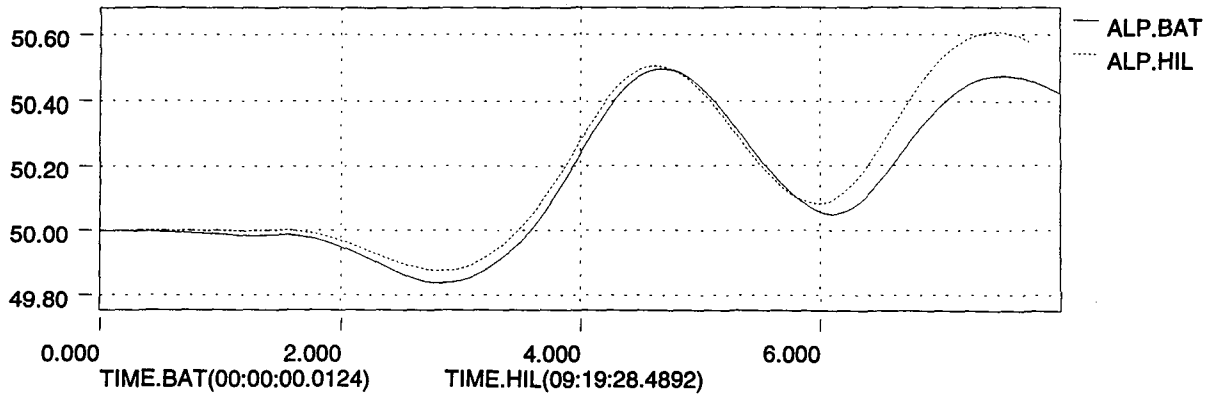
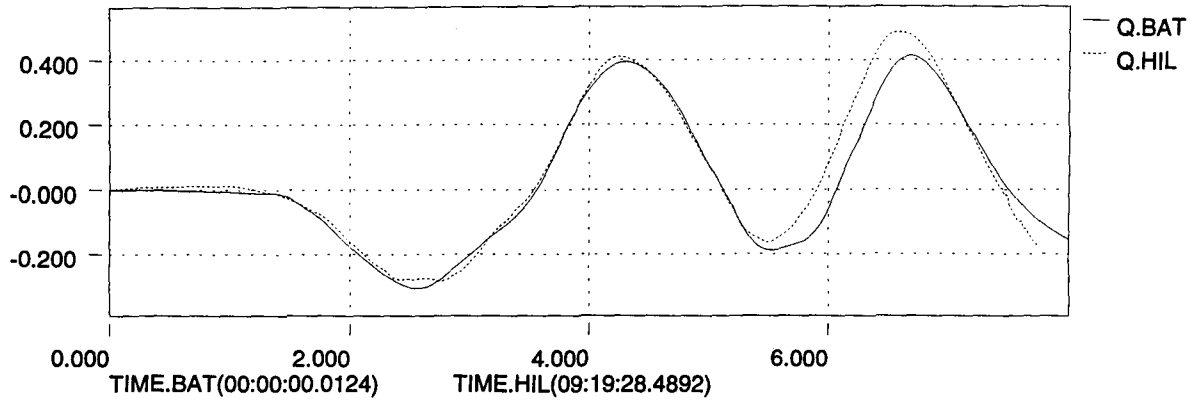
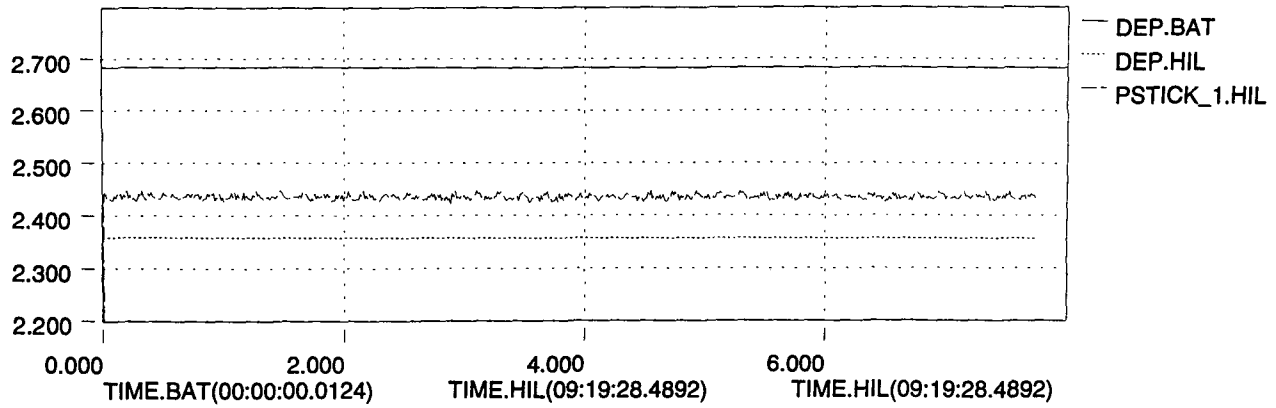
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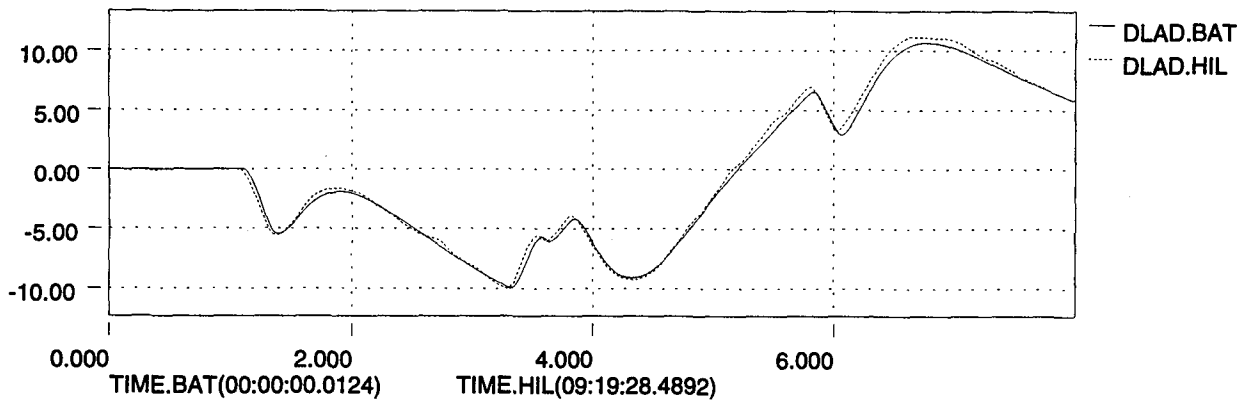
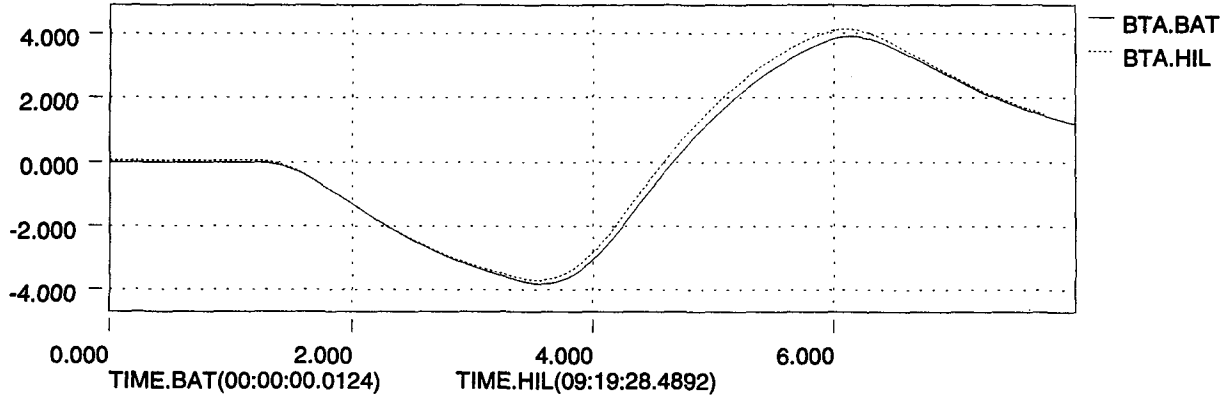
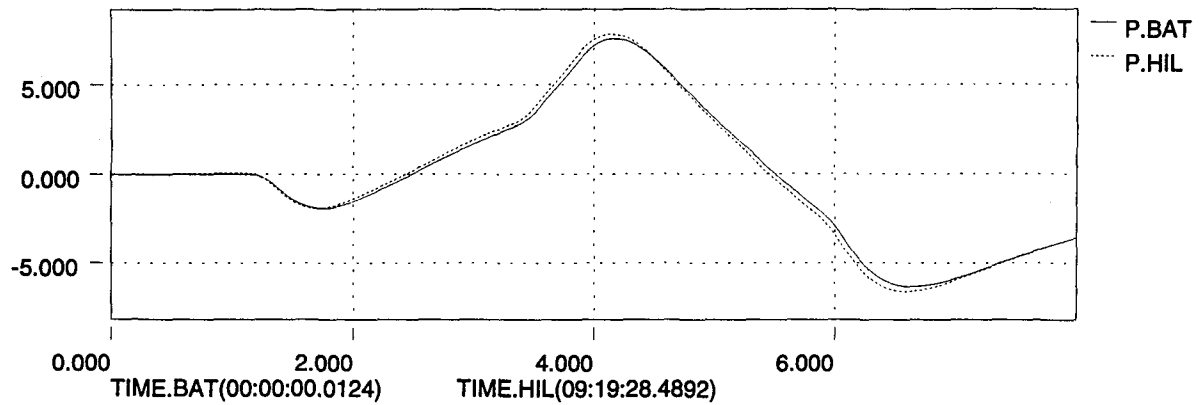
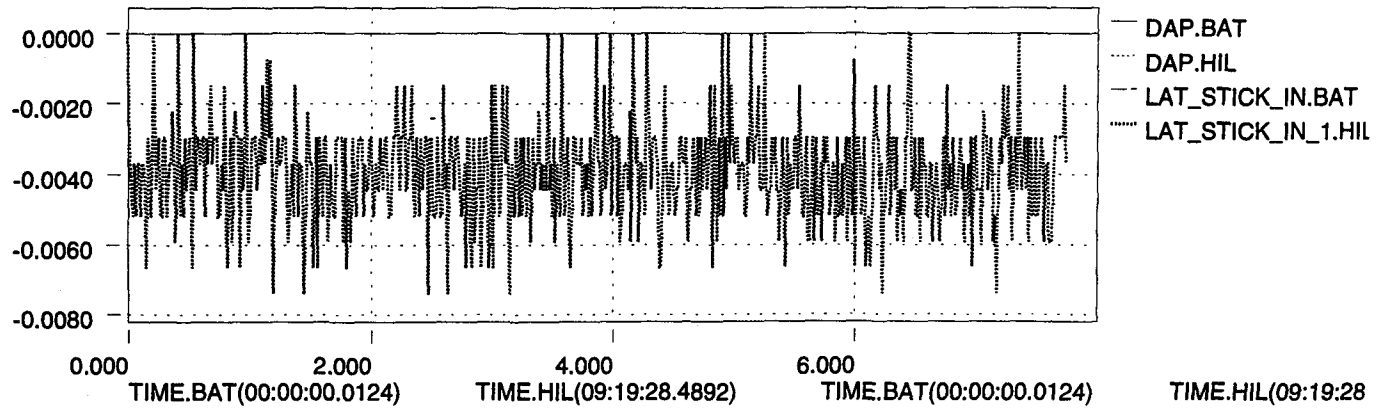
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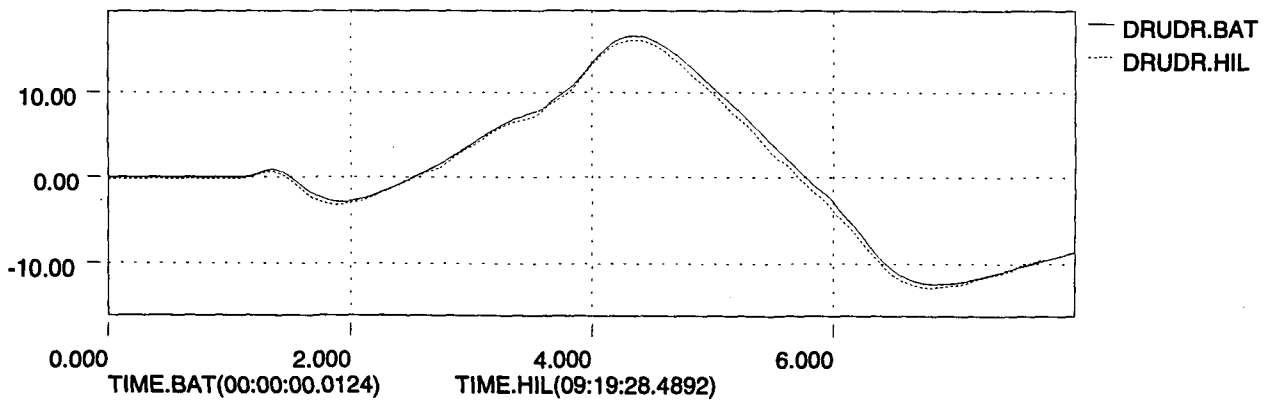
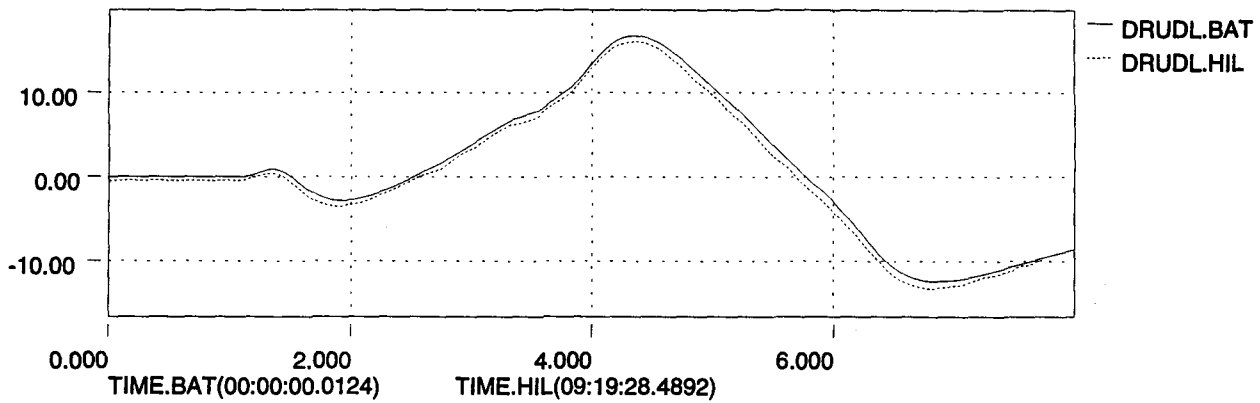
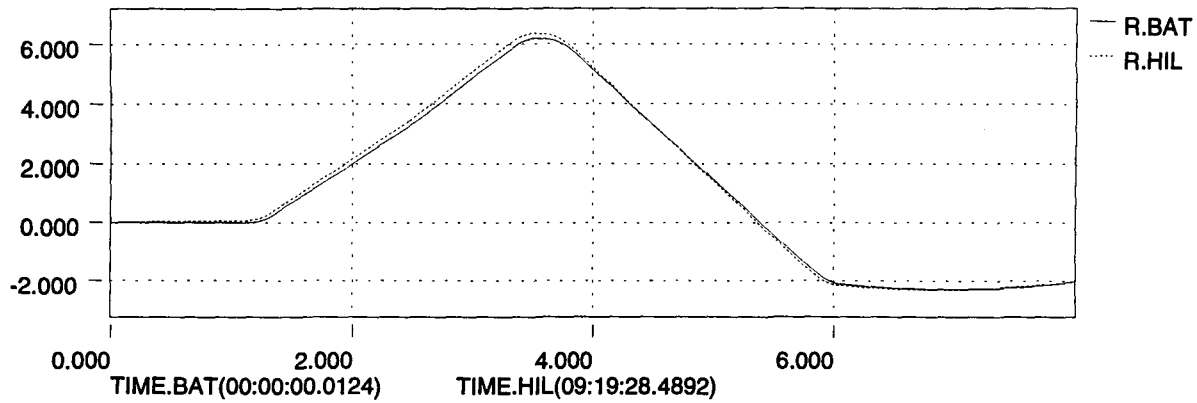
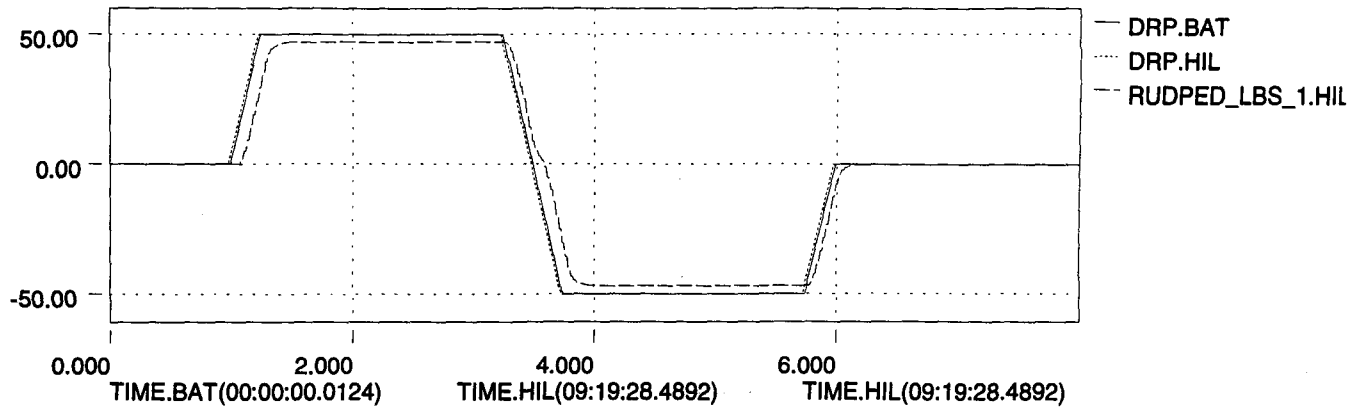
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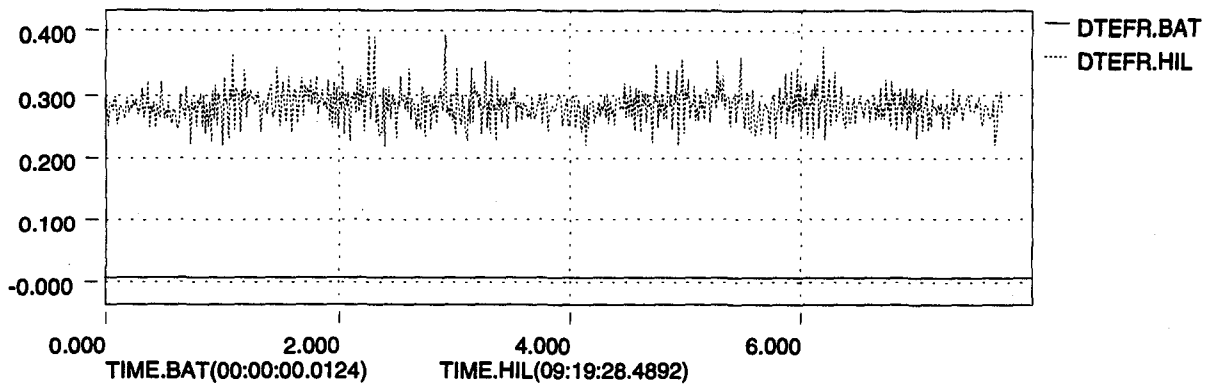
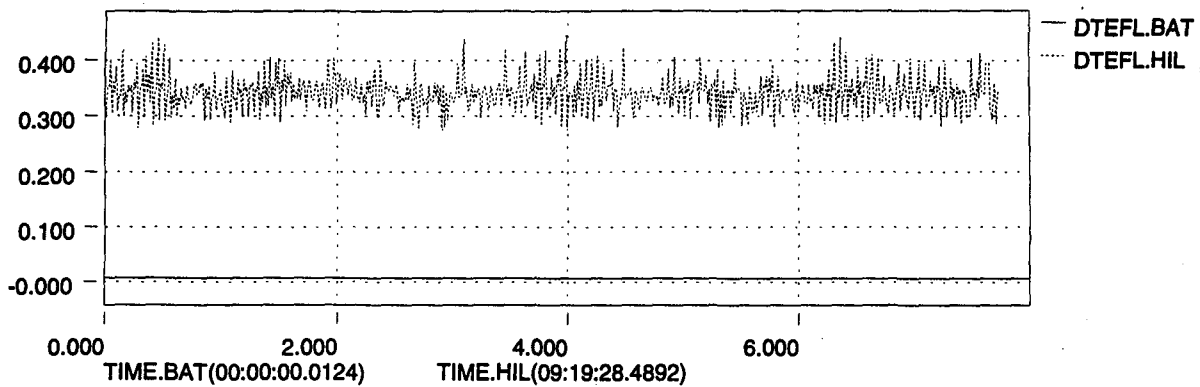
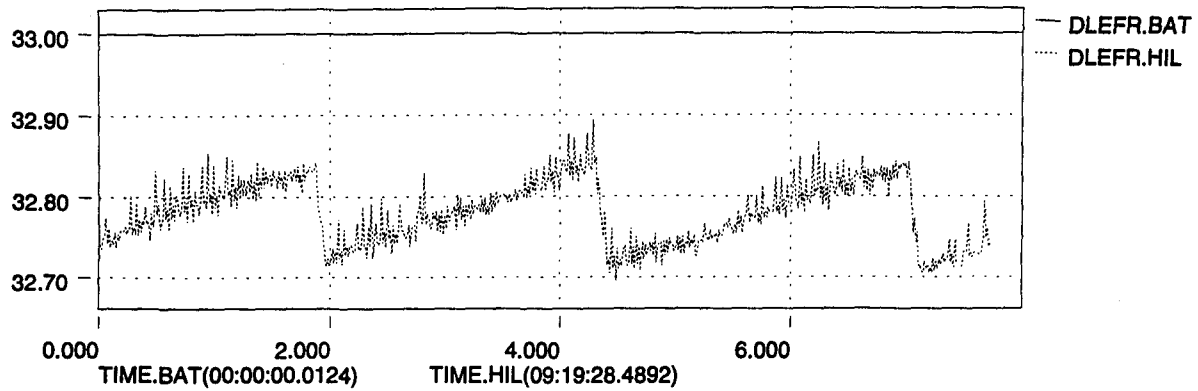
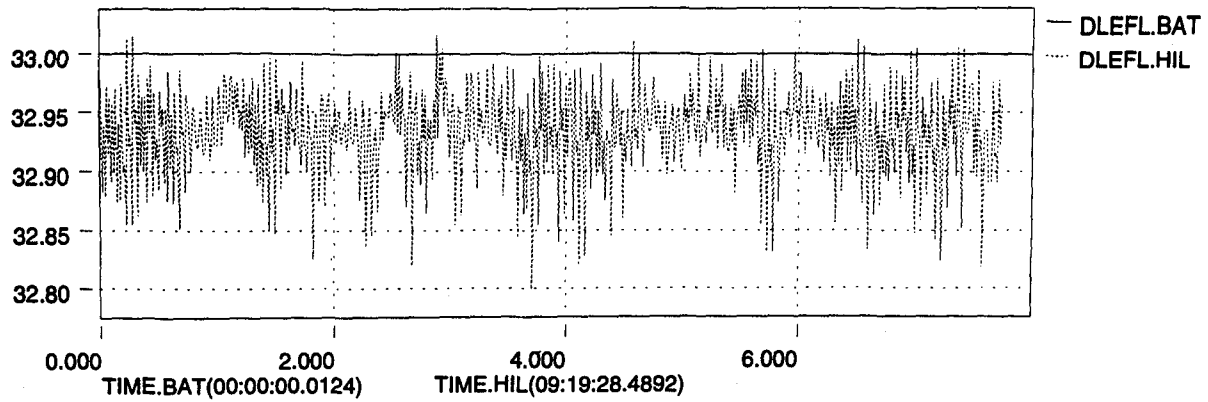


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207

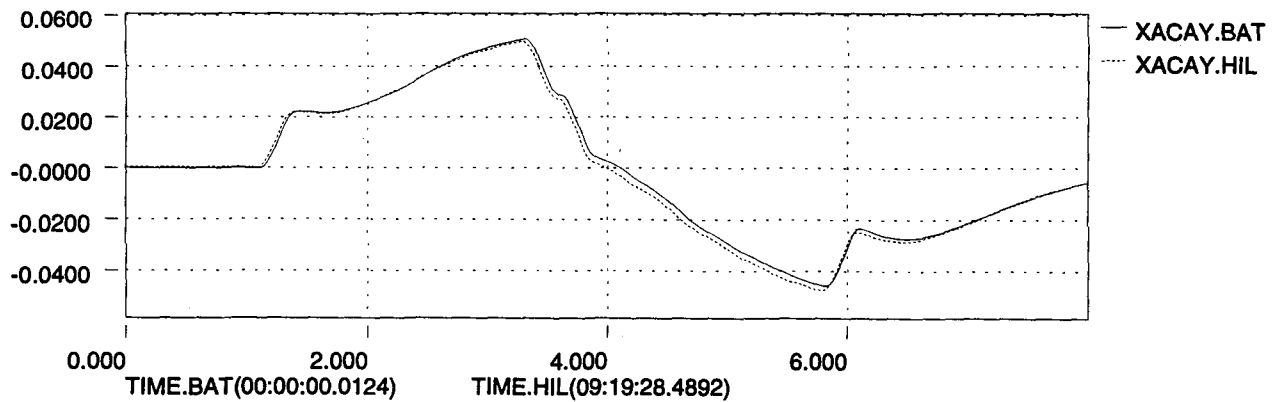
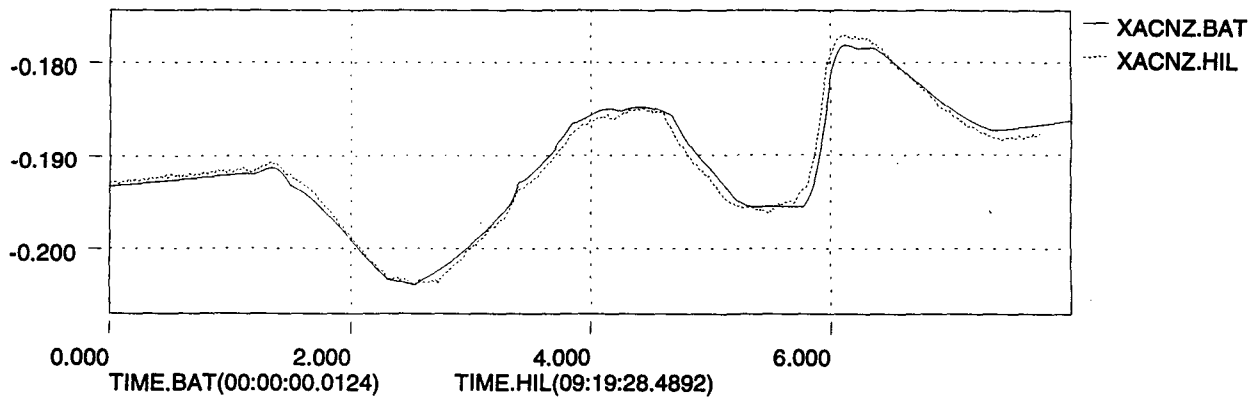
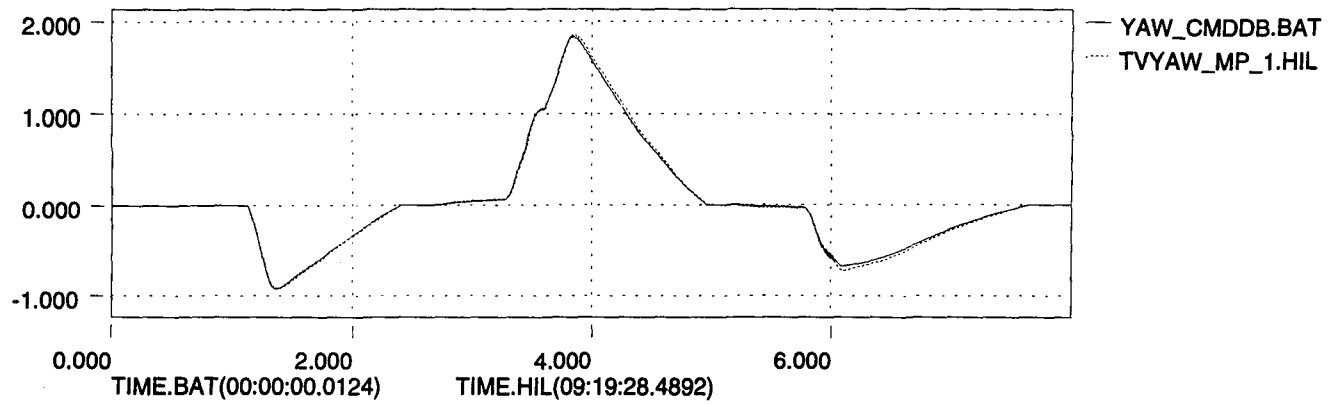
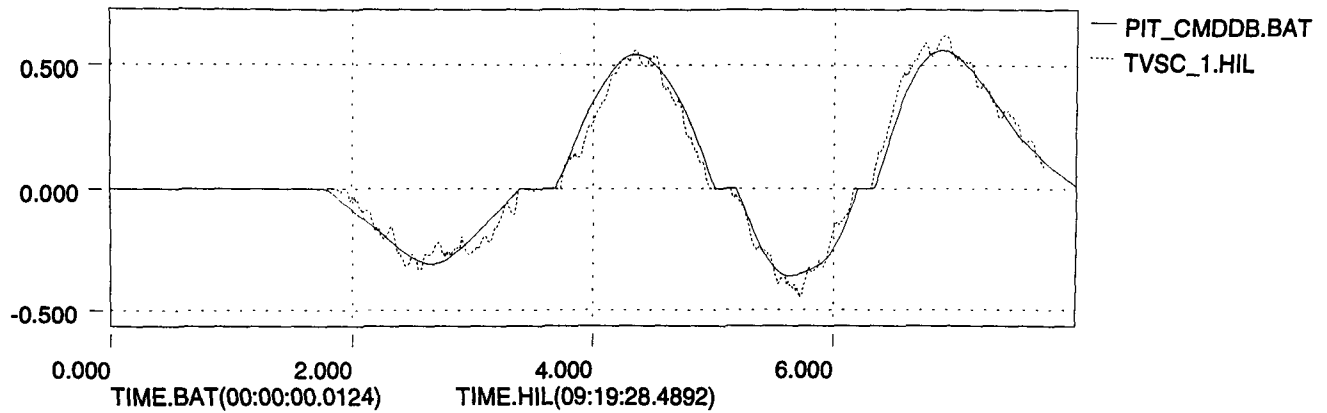


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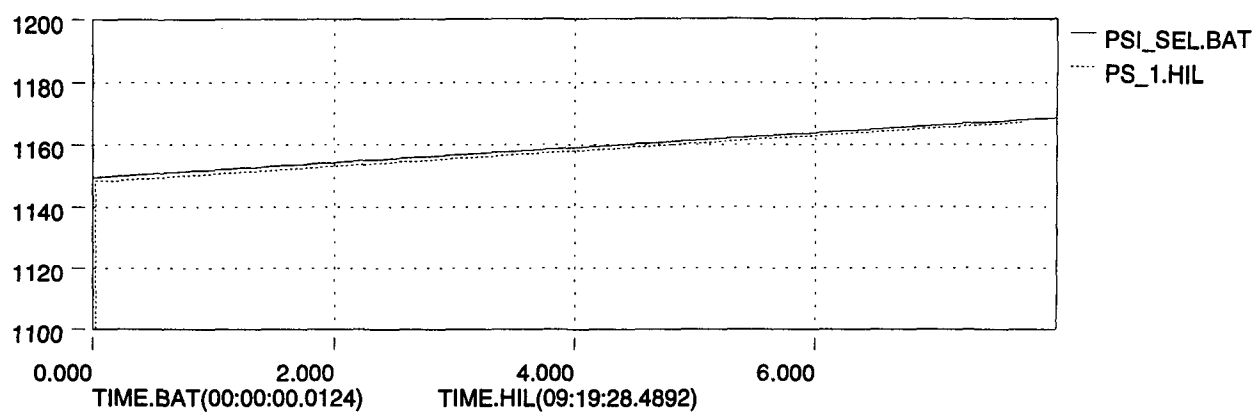
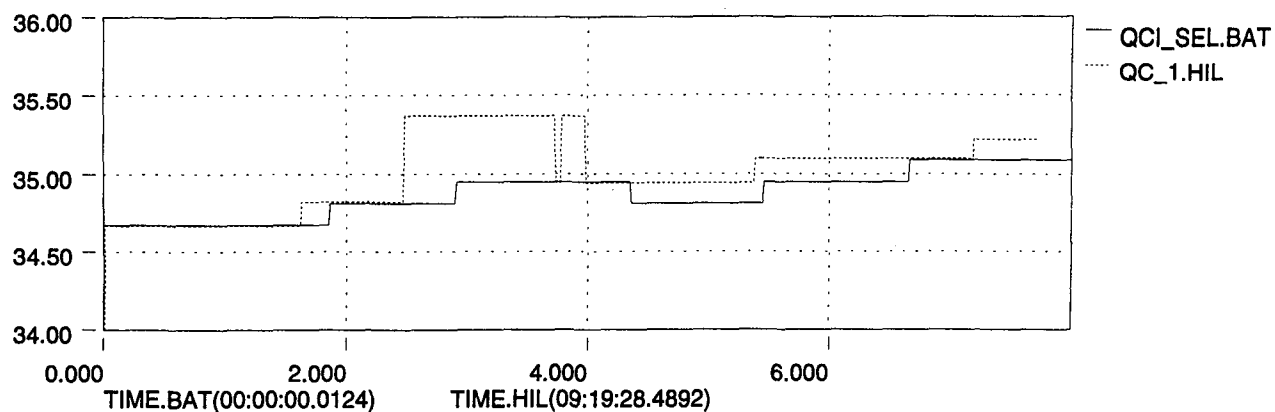
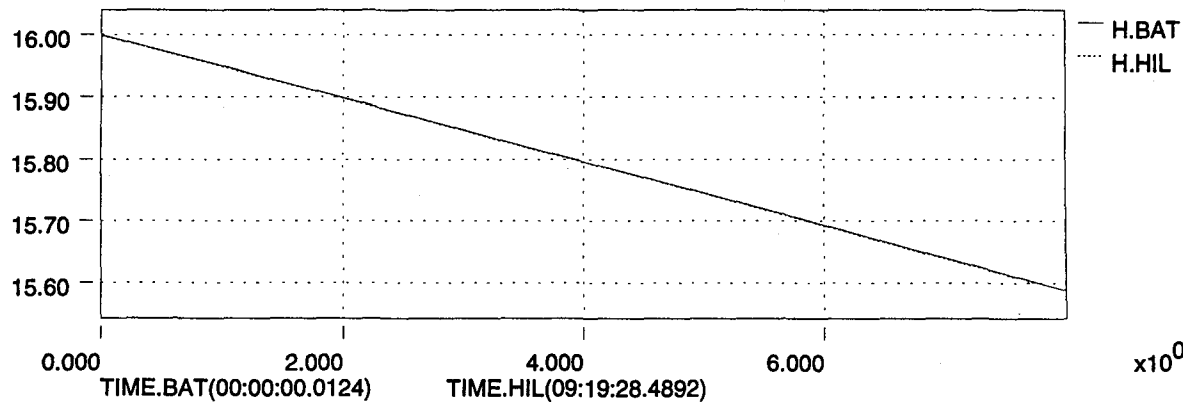
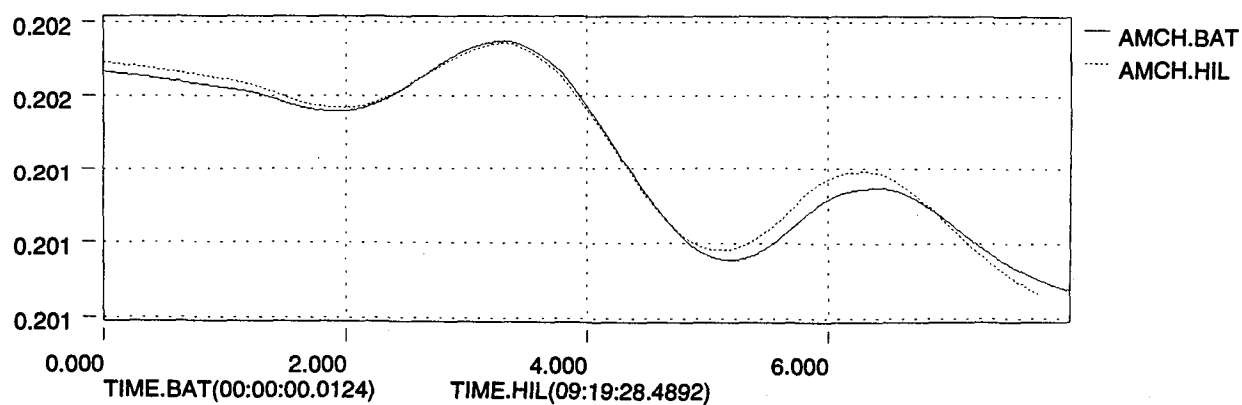
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309



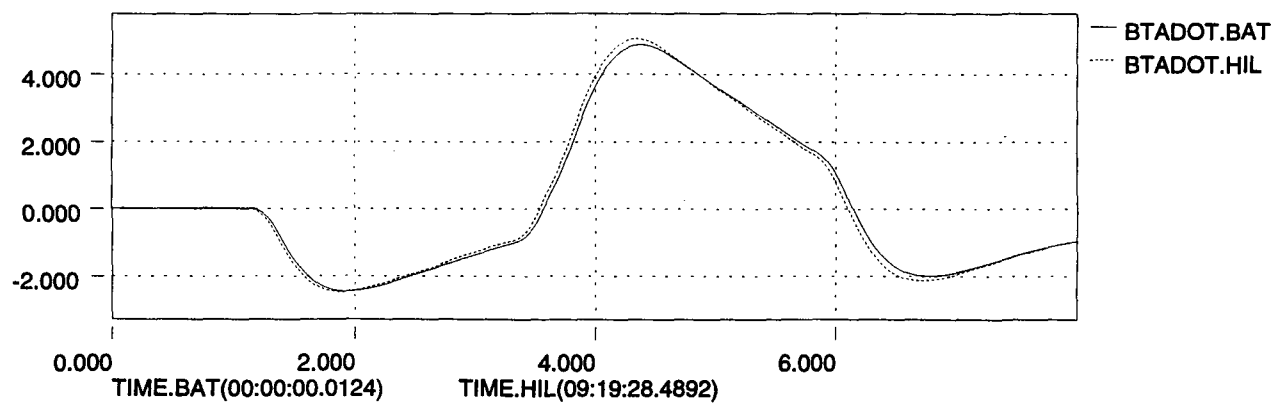
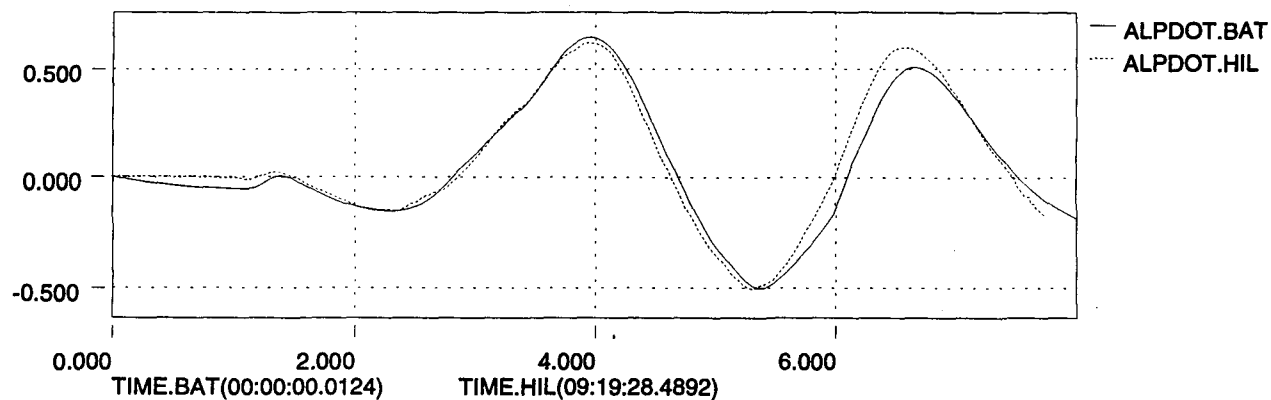
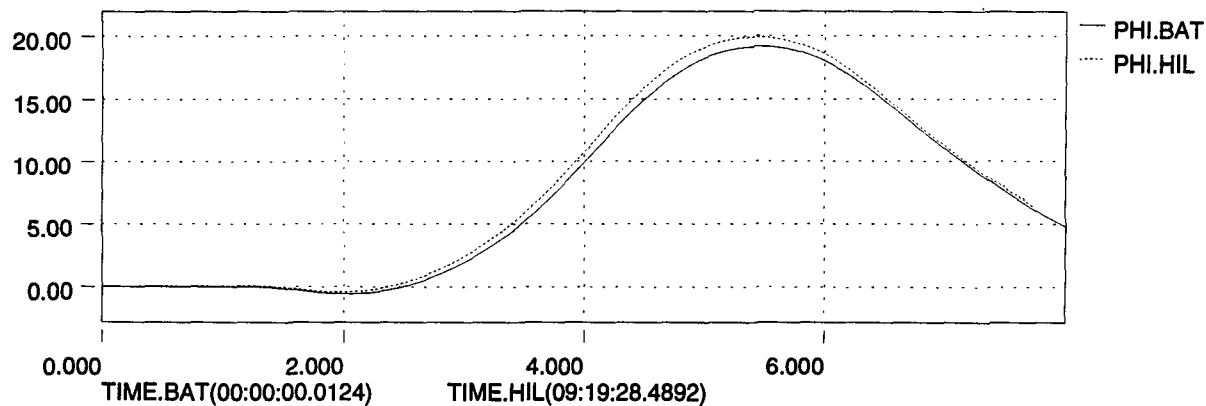
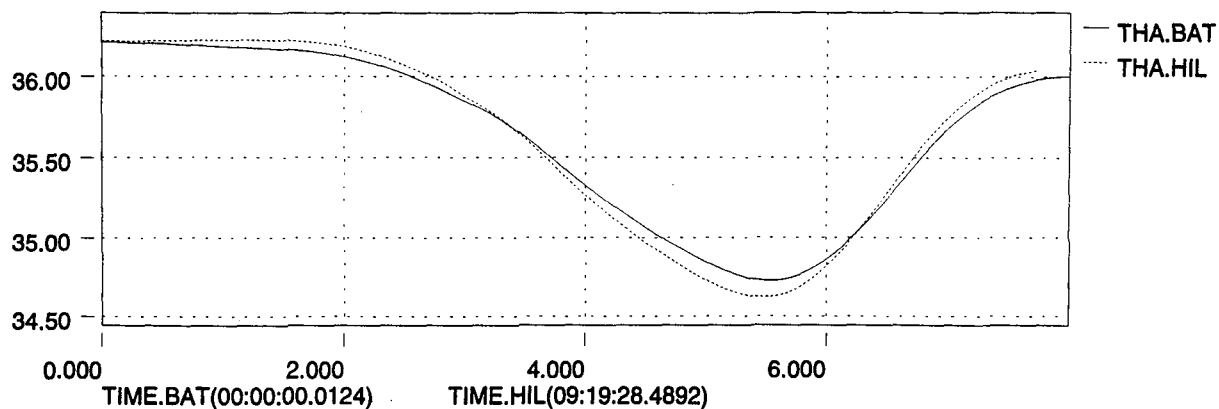
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210

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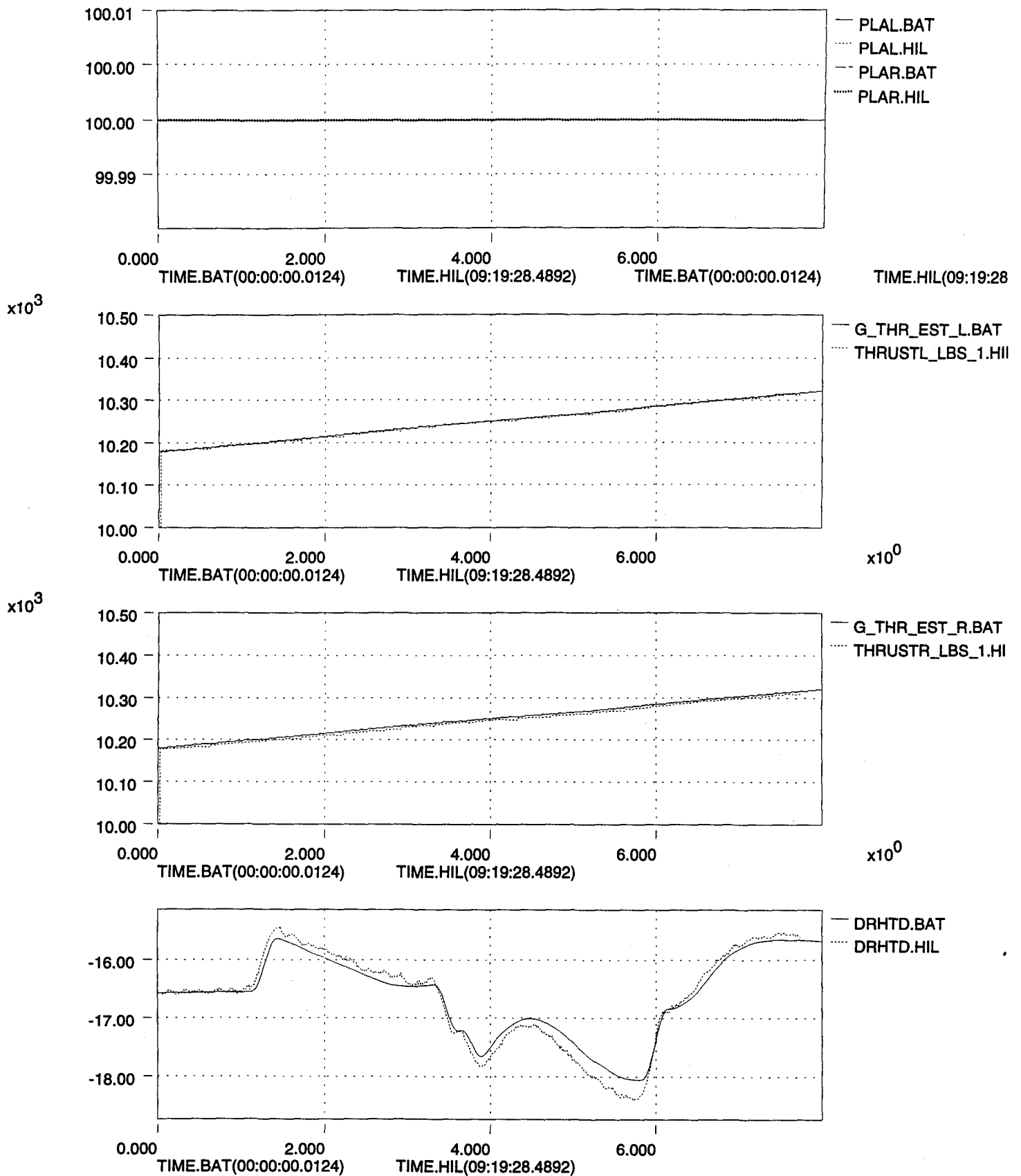
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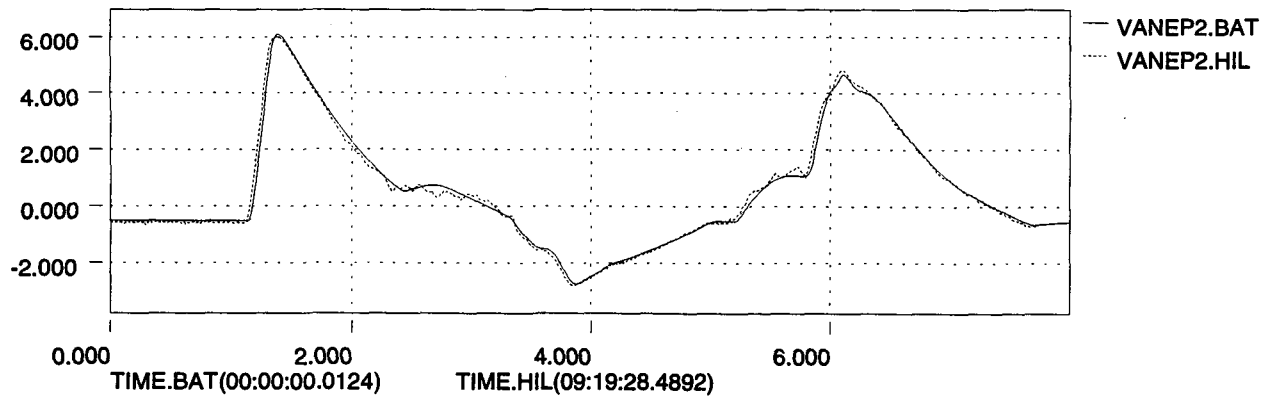
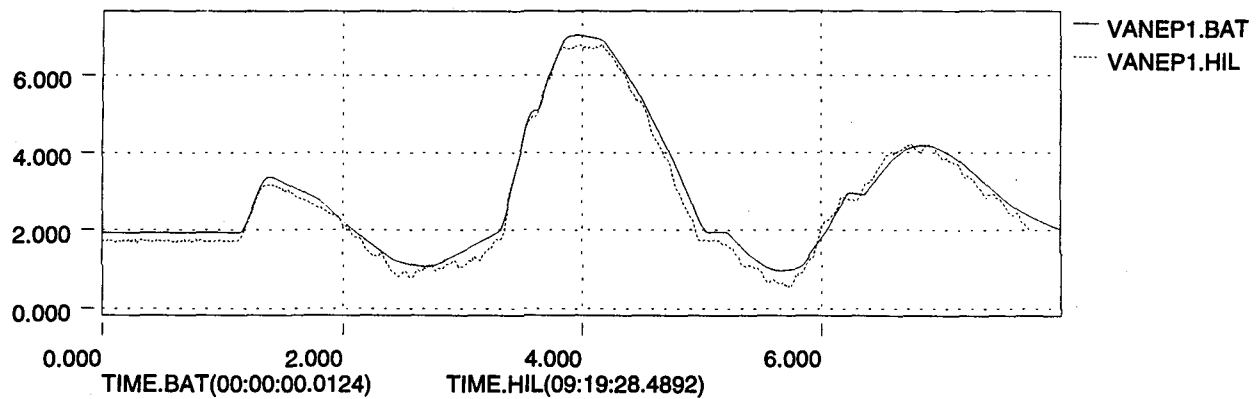
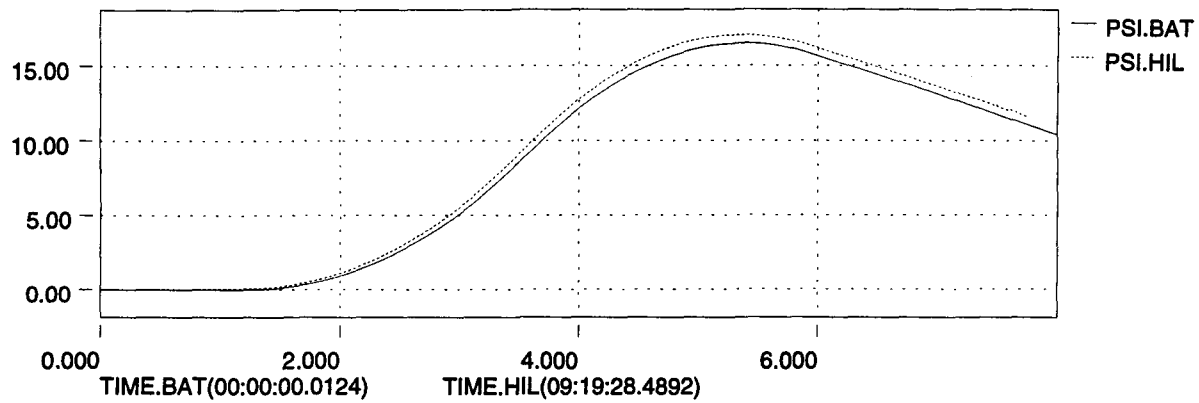
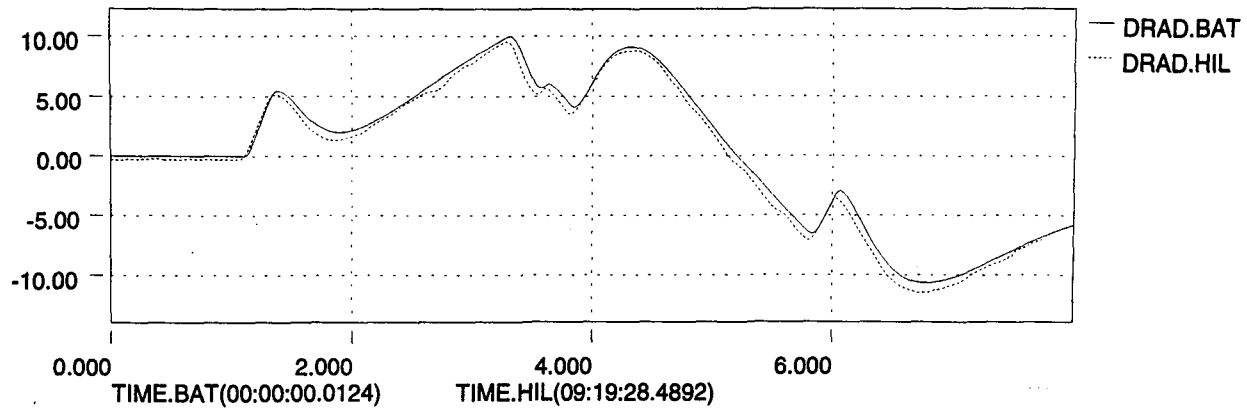


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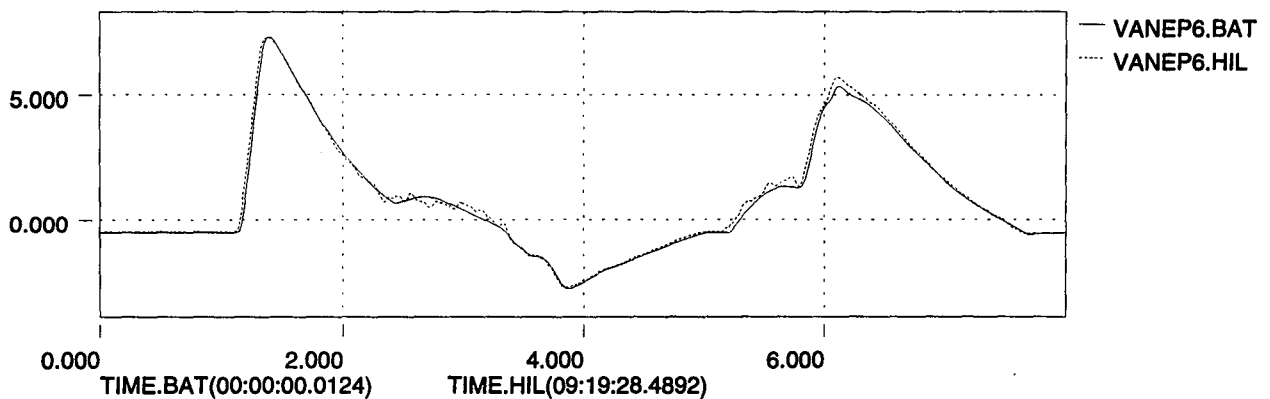
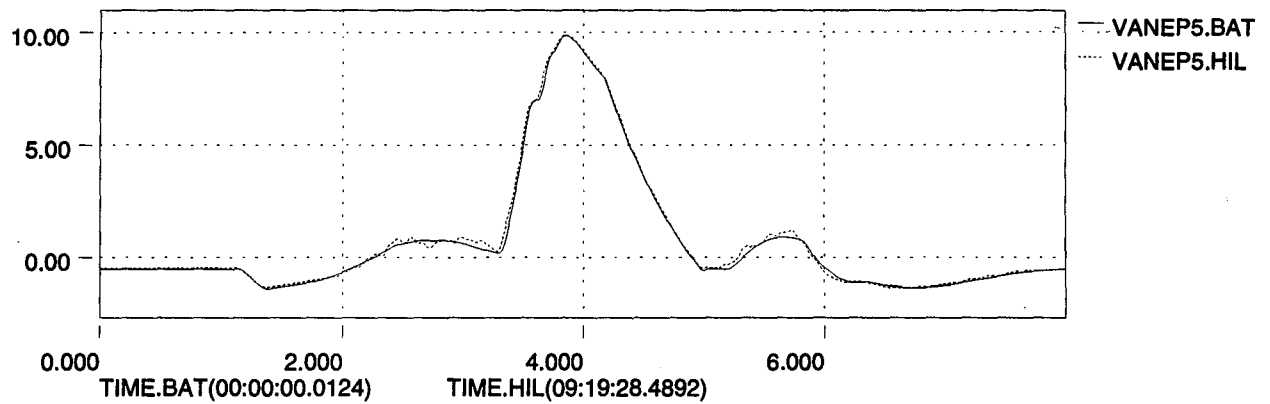
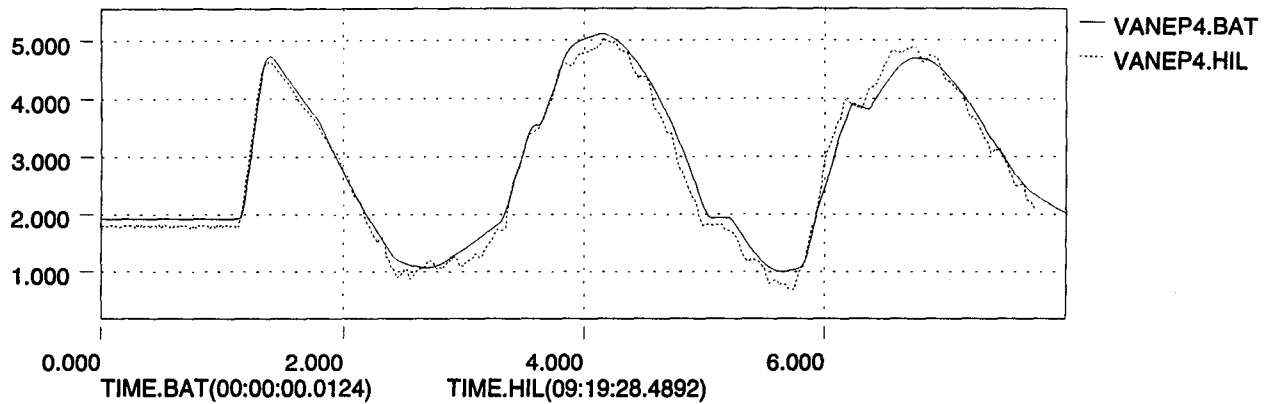
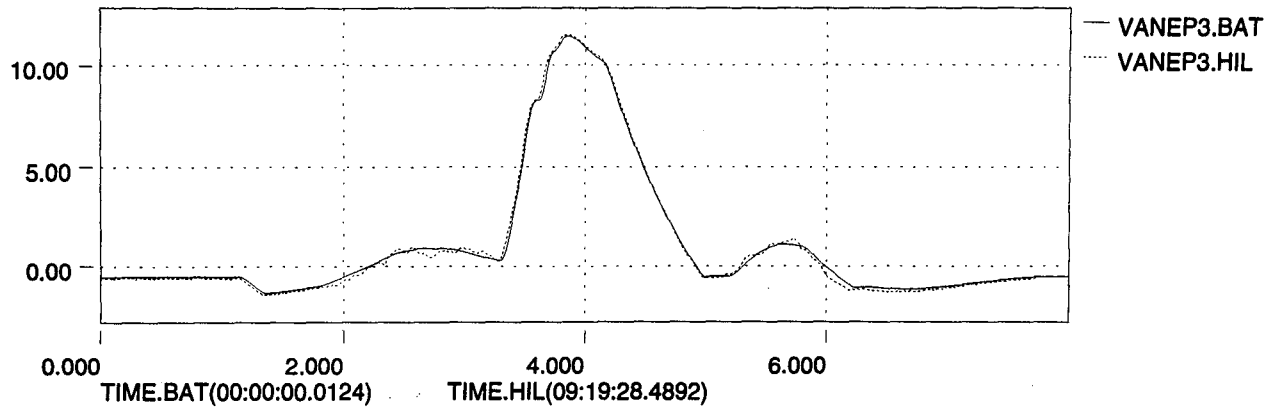
212



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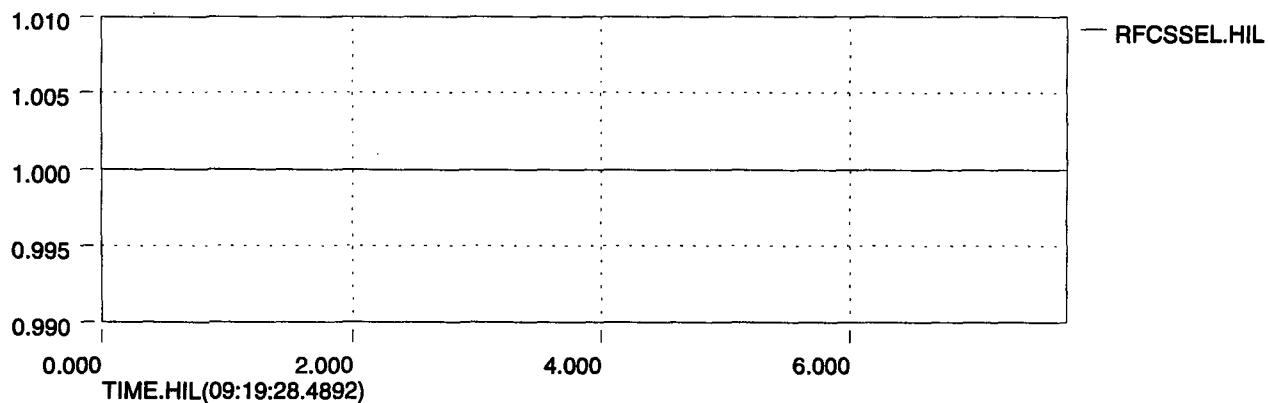
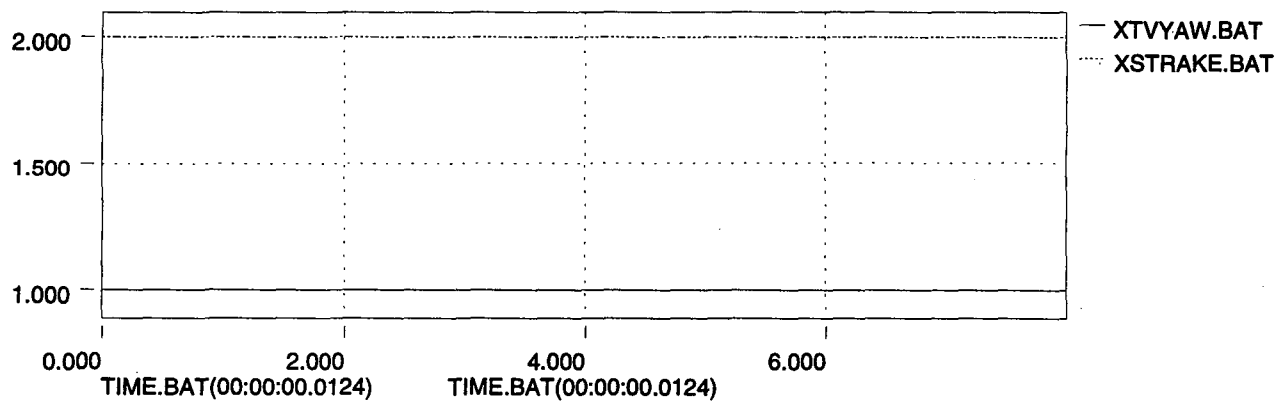
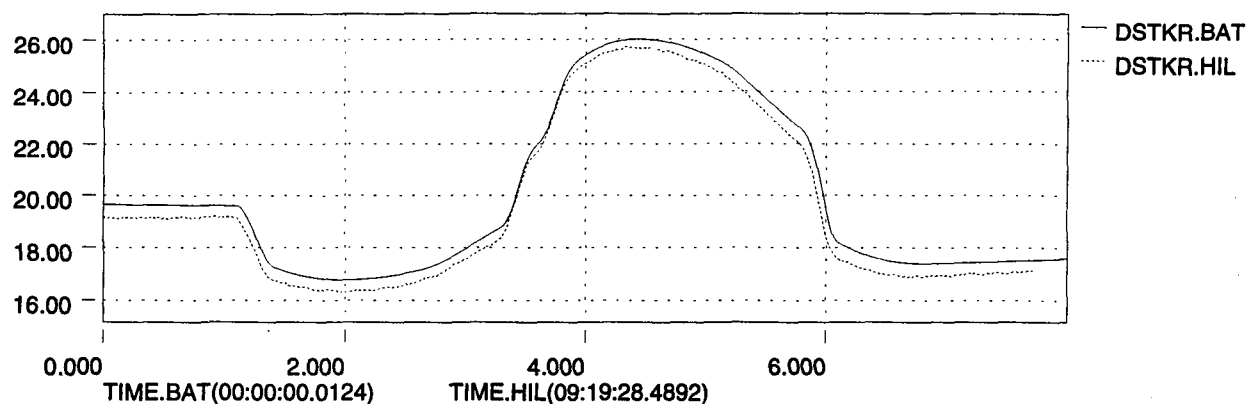
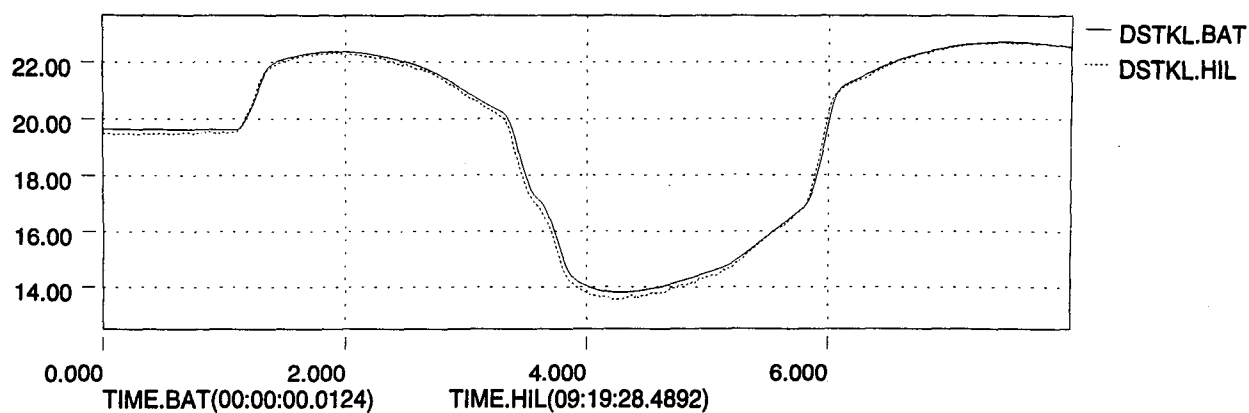


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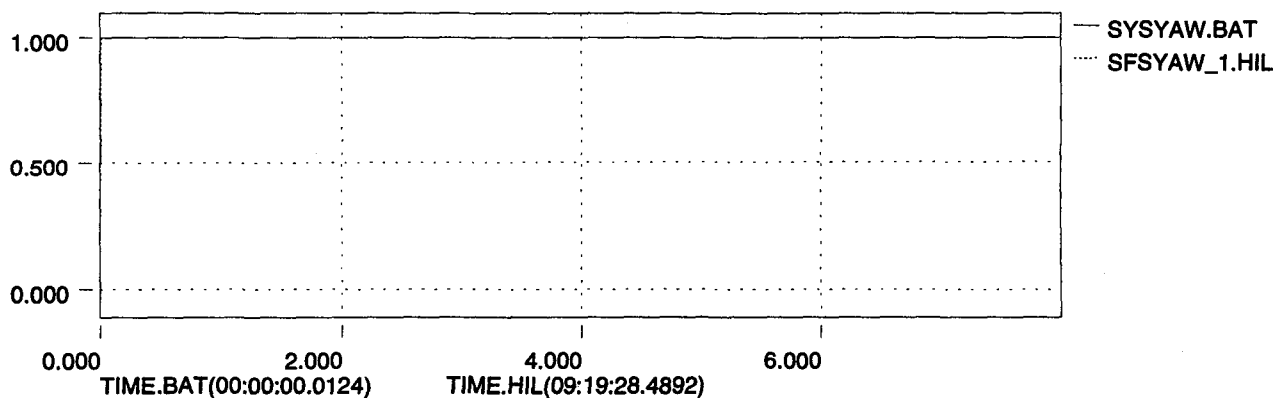
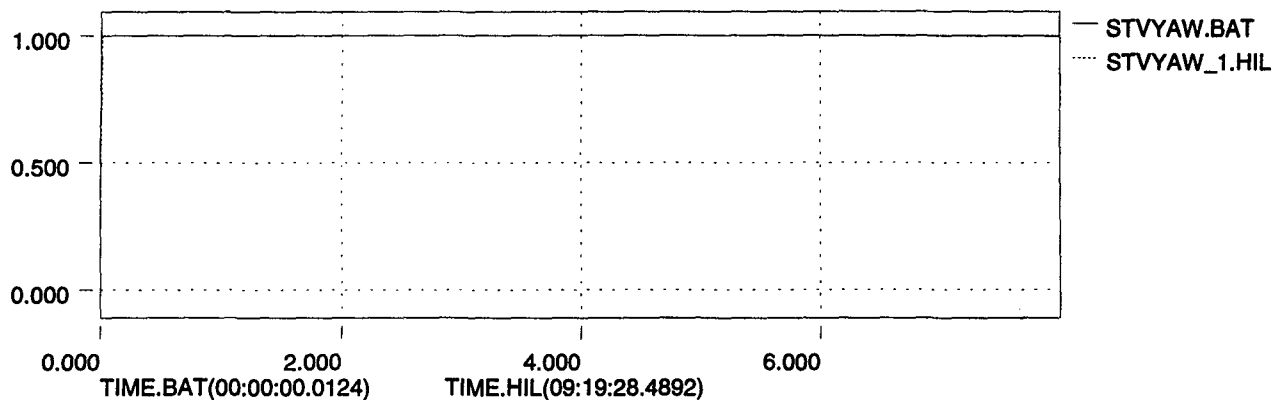
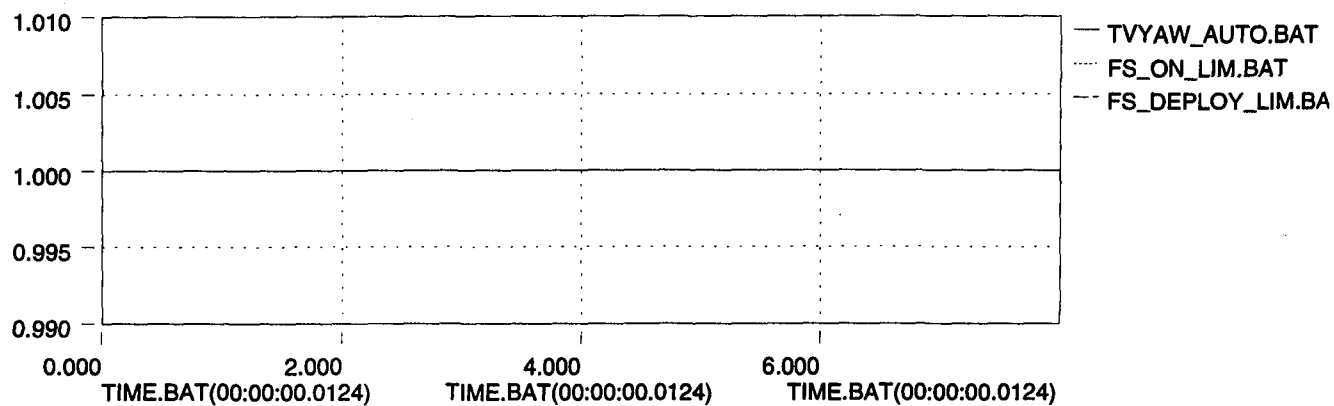
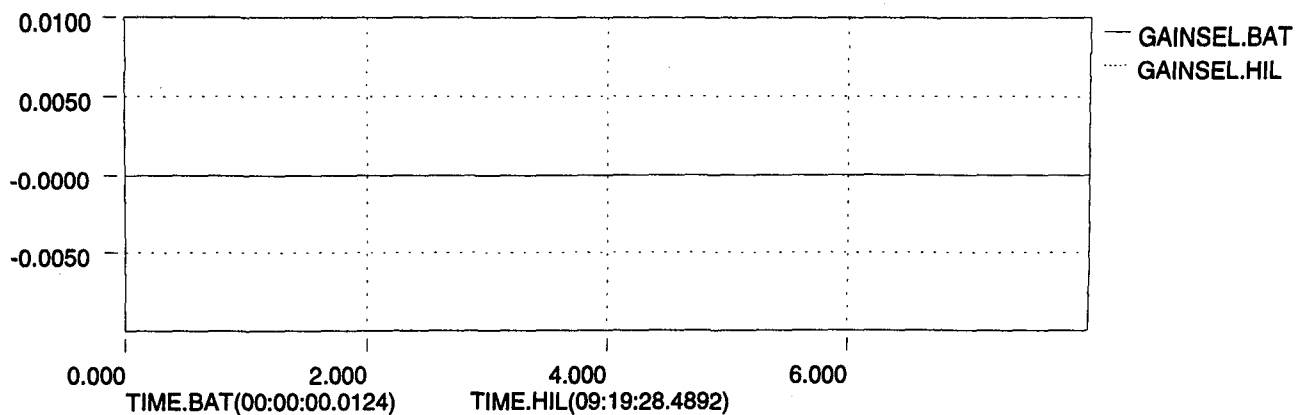
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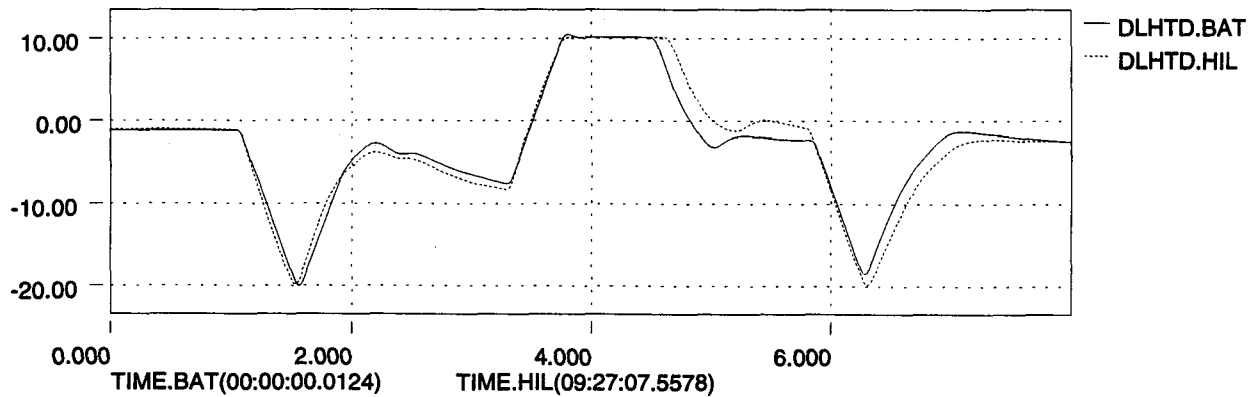
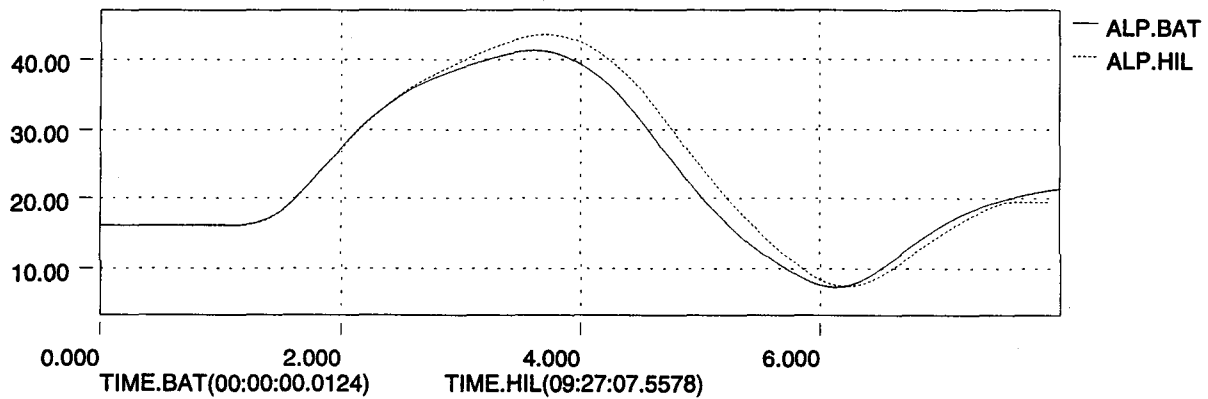
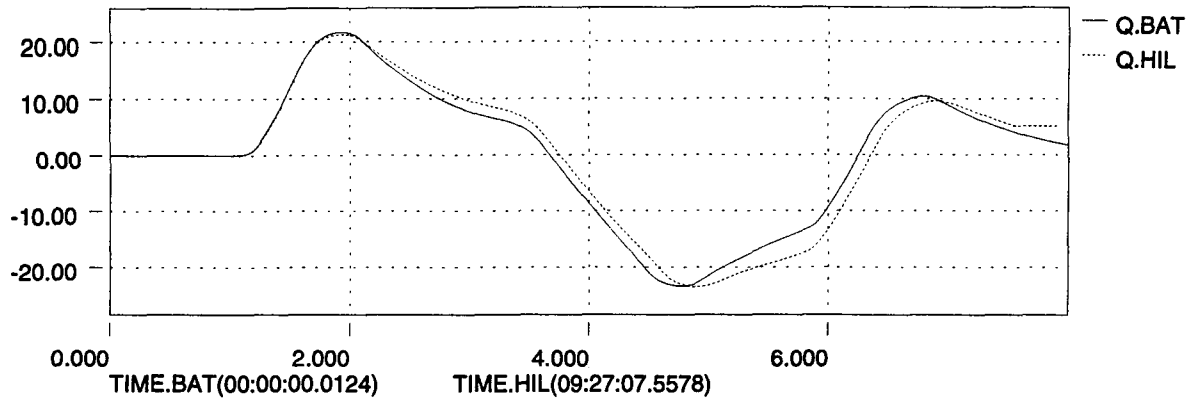
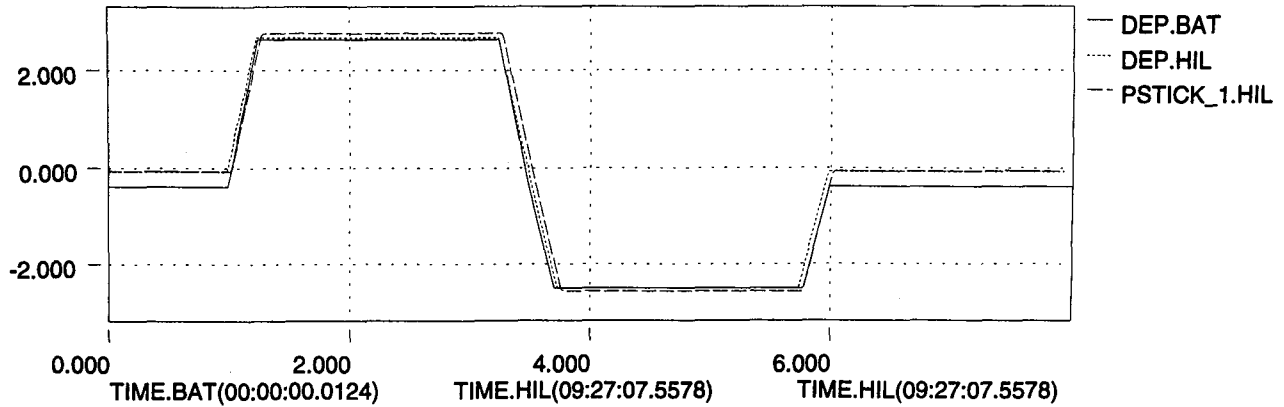
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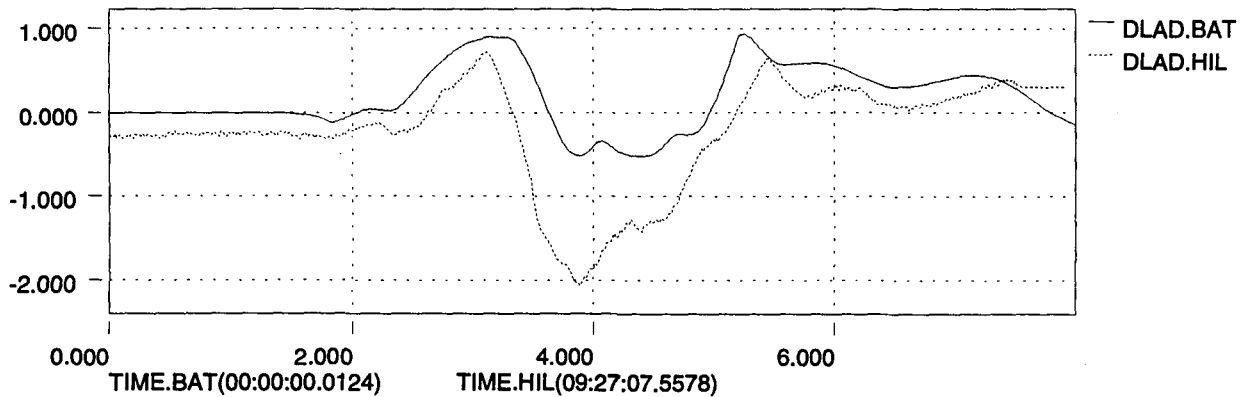
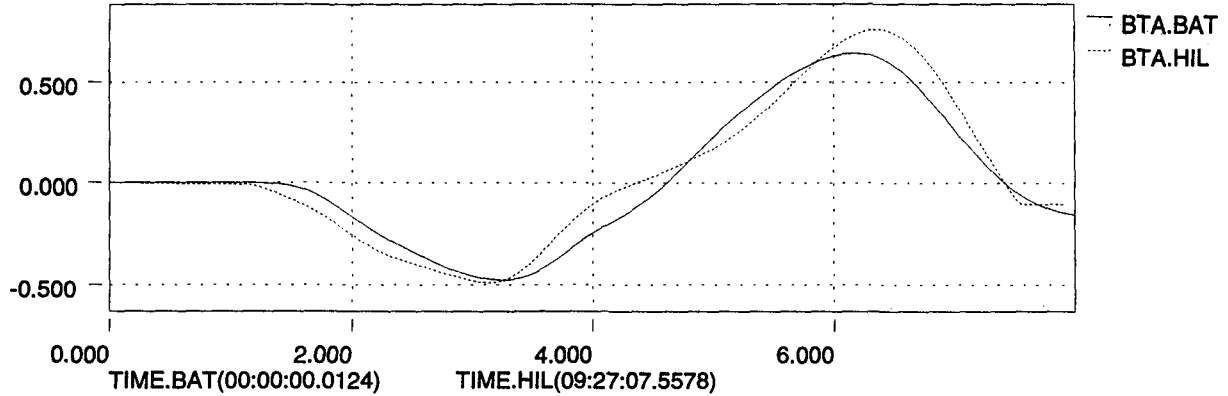
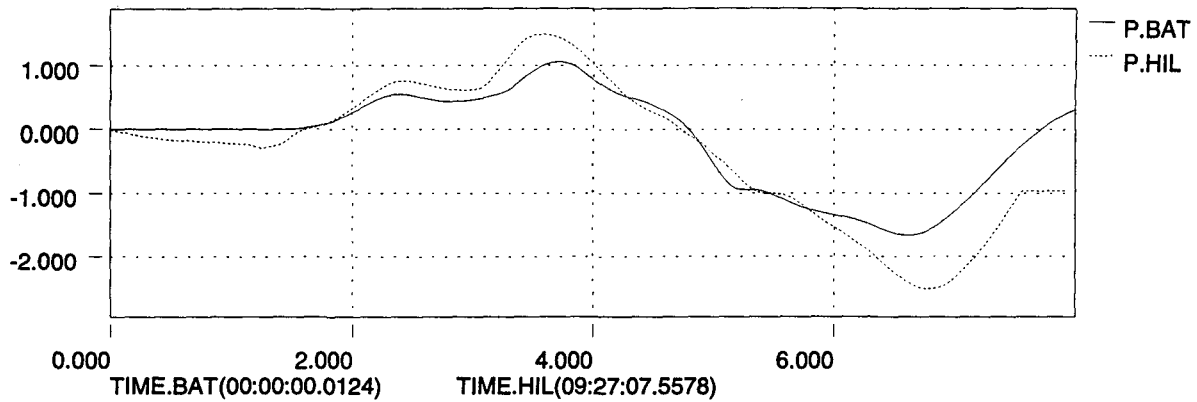
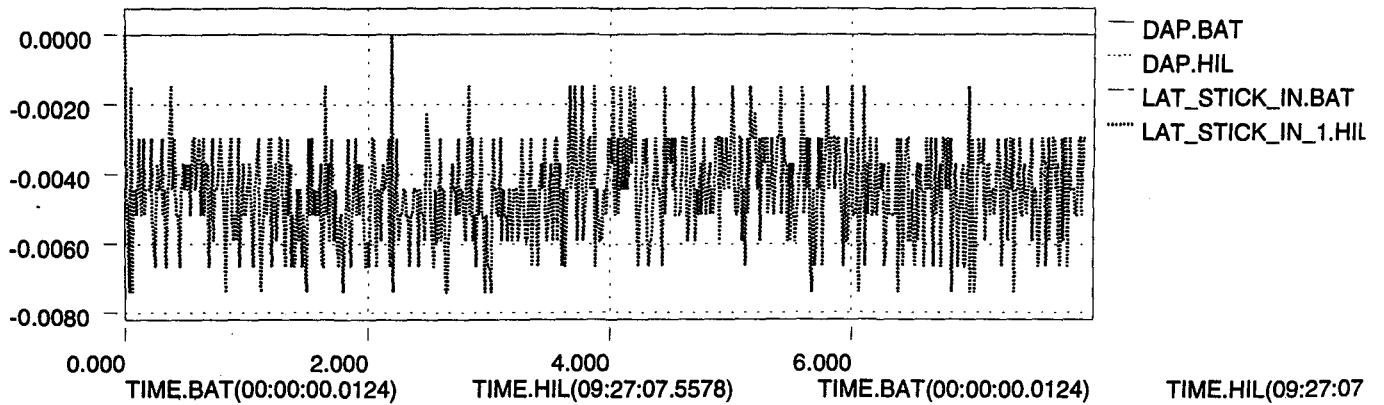


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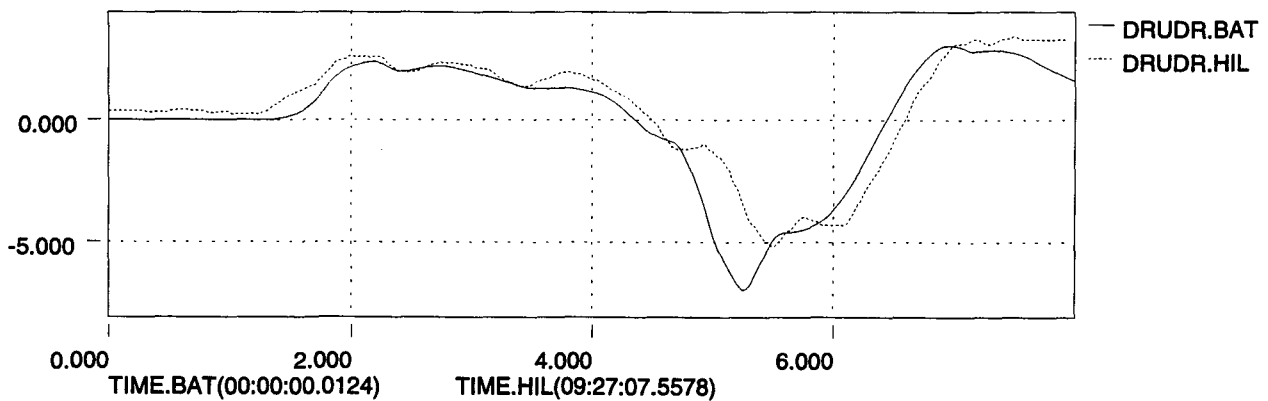
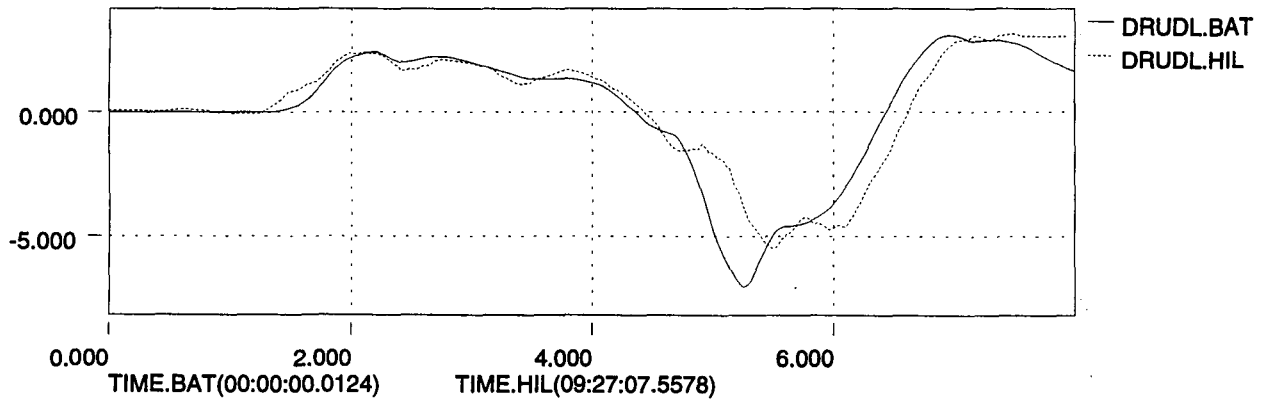
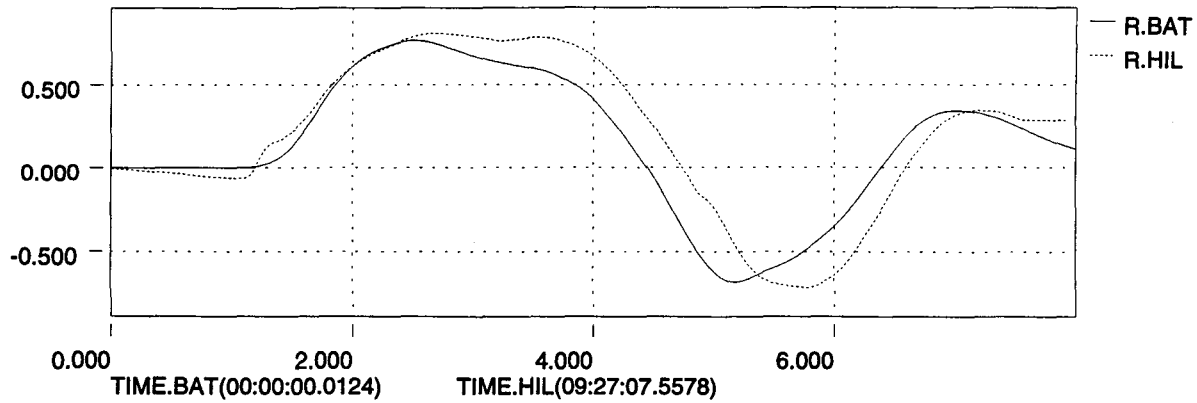
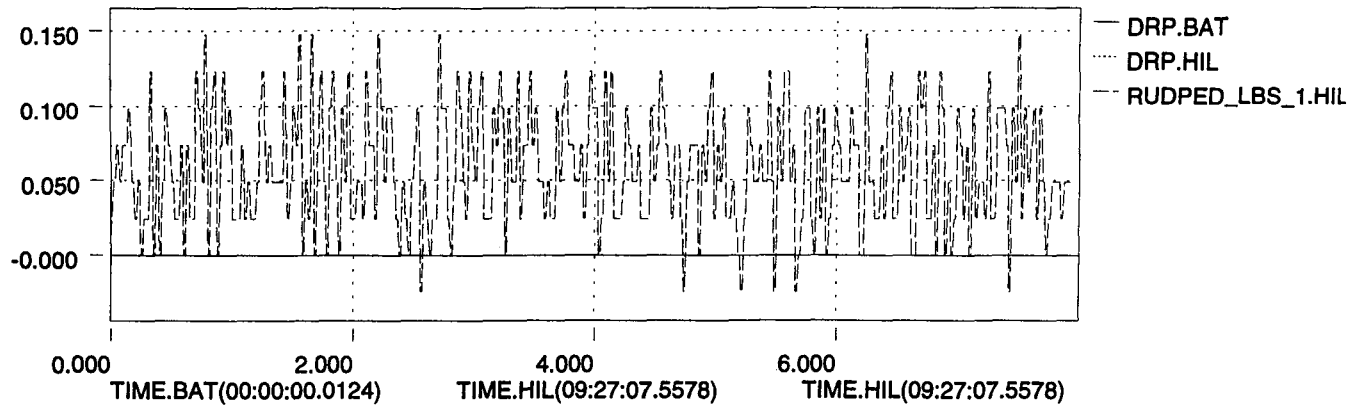
217



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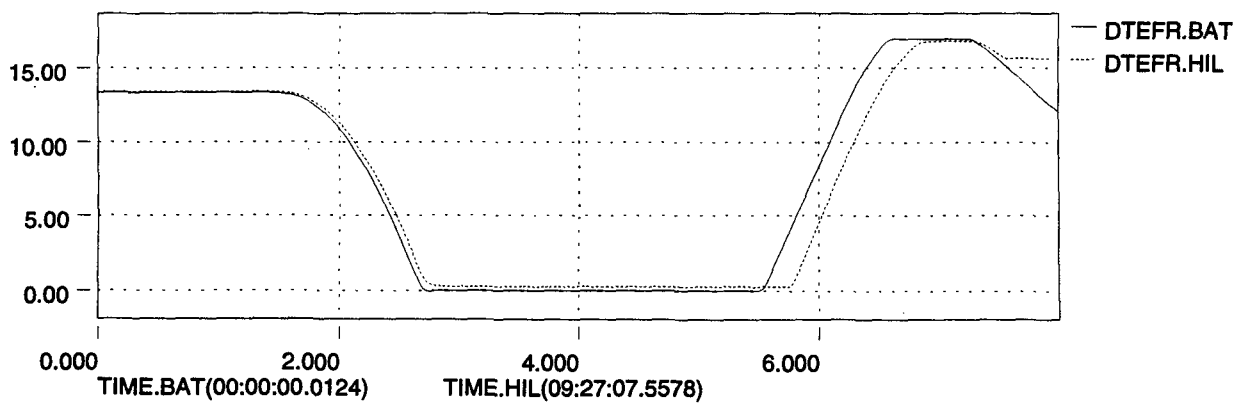
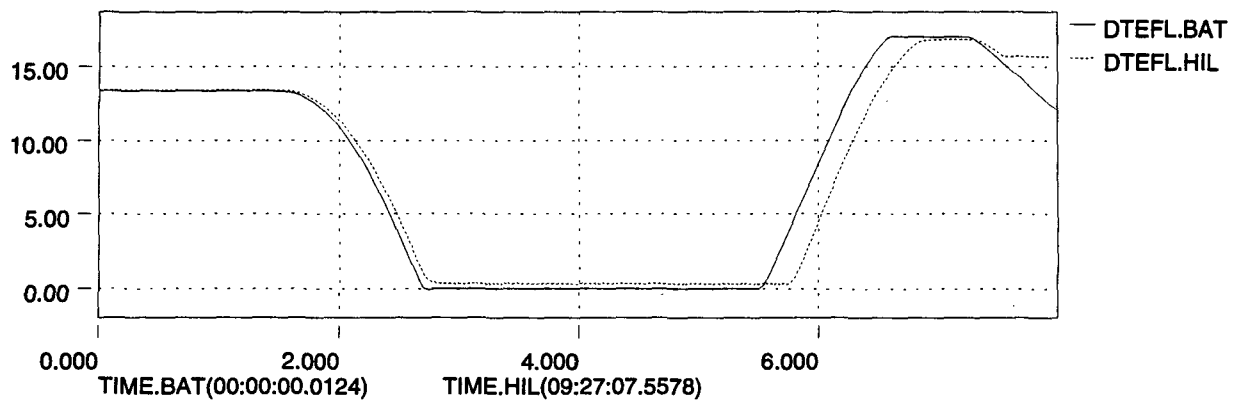
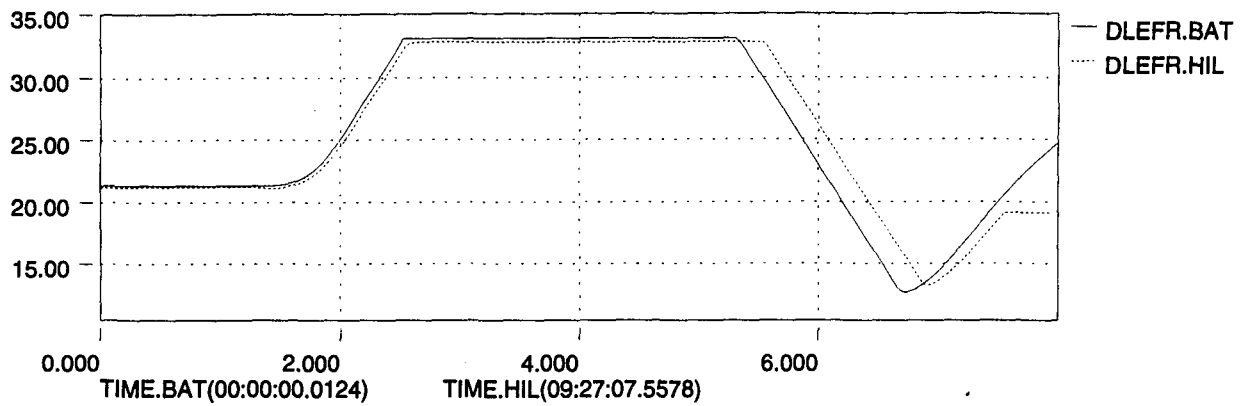
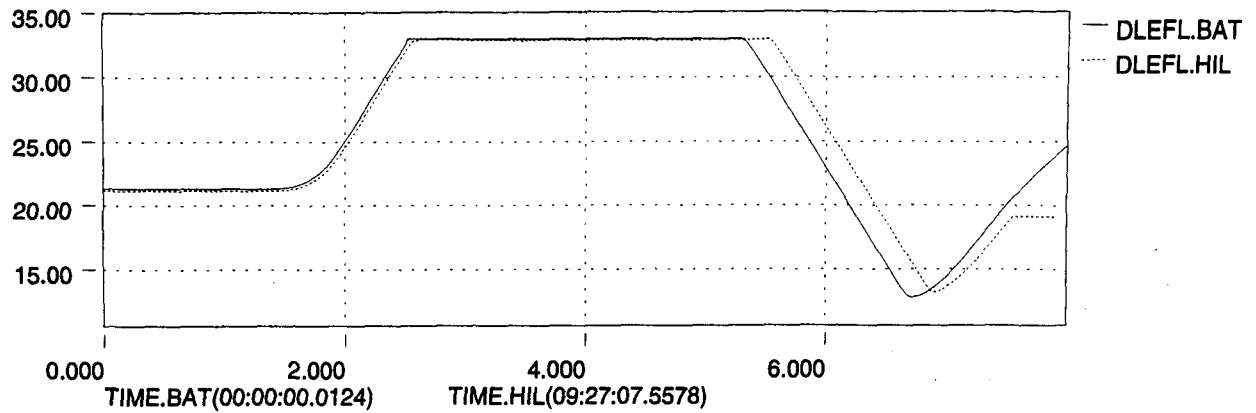


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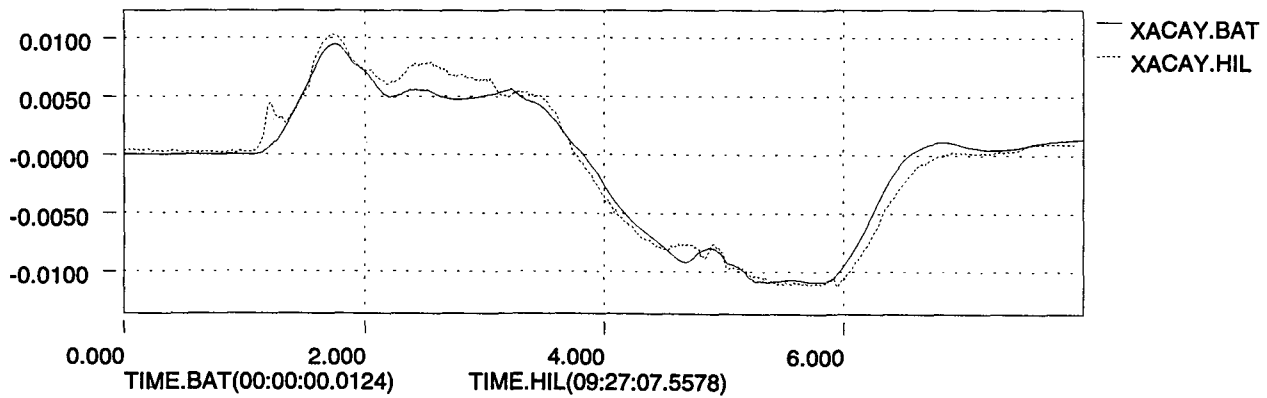
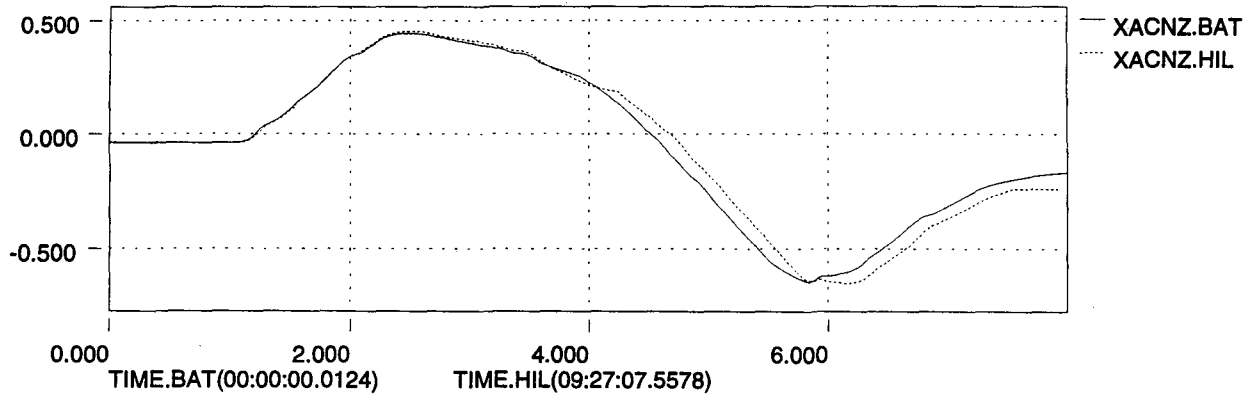
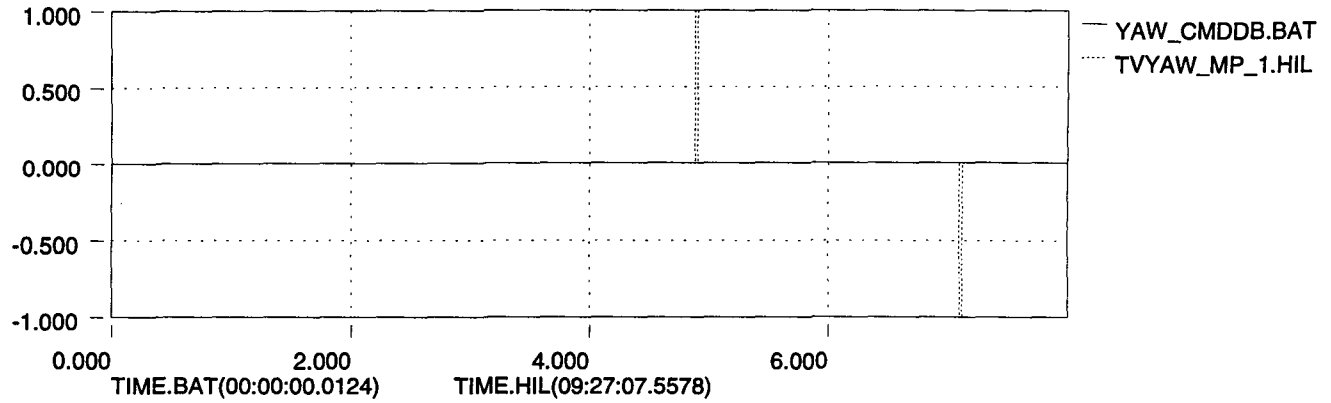
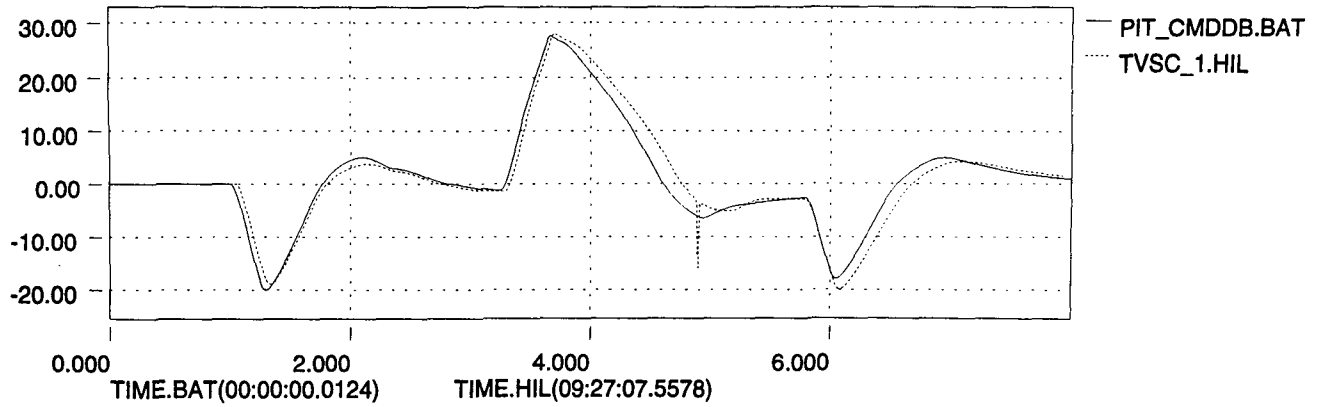
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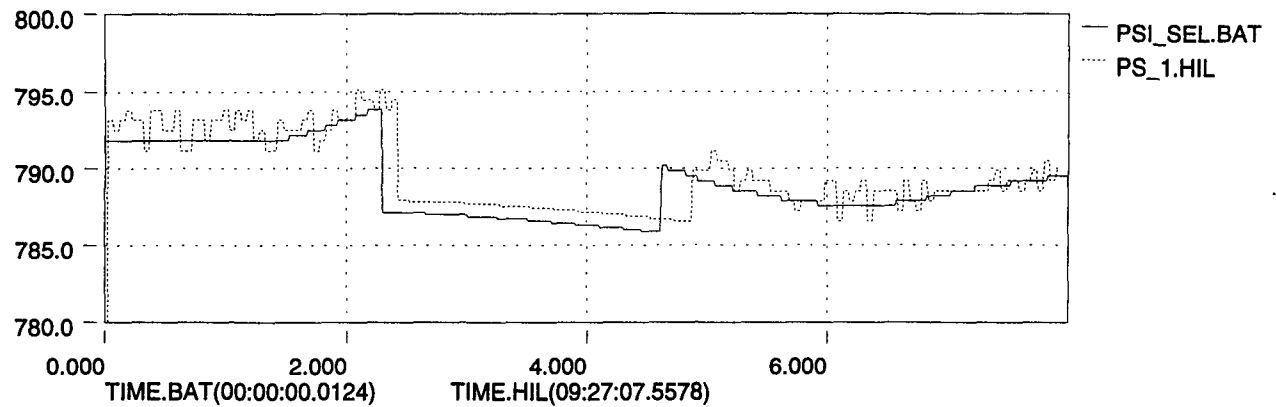
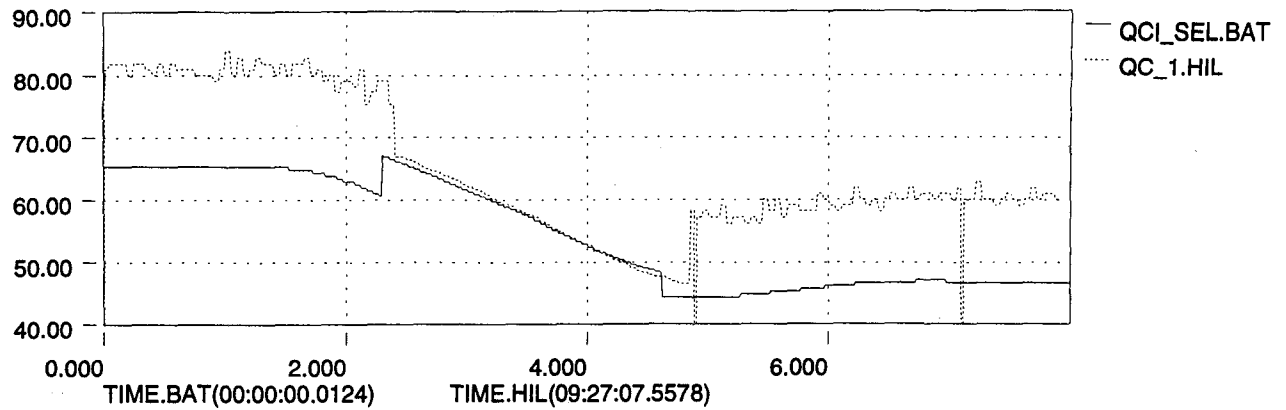
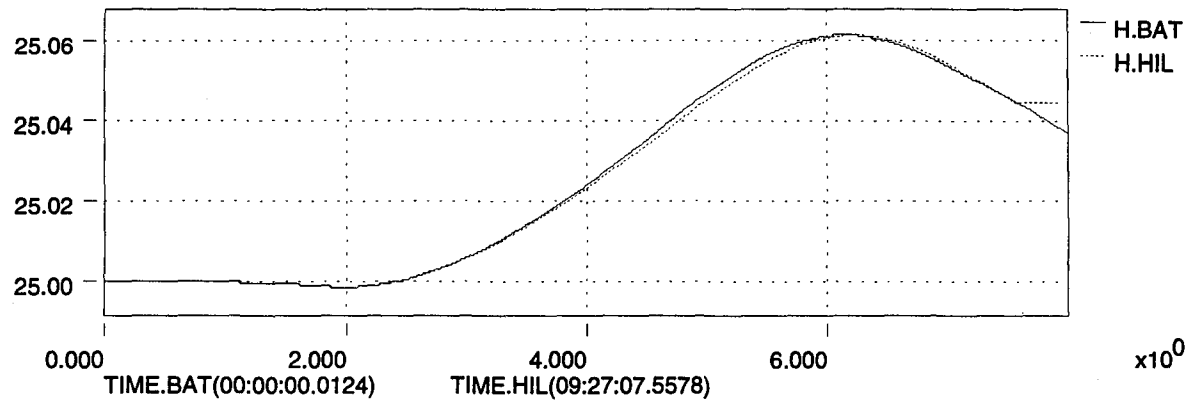
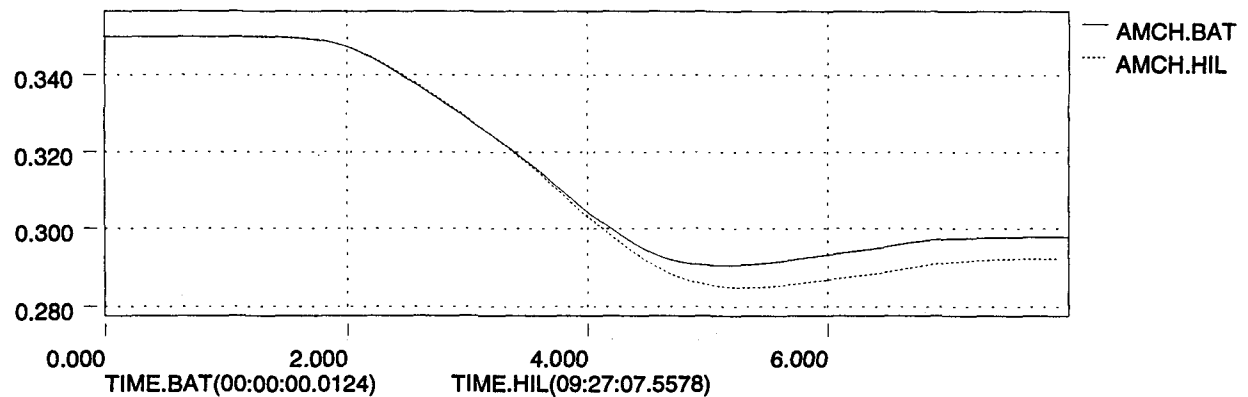
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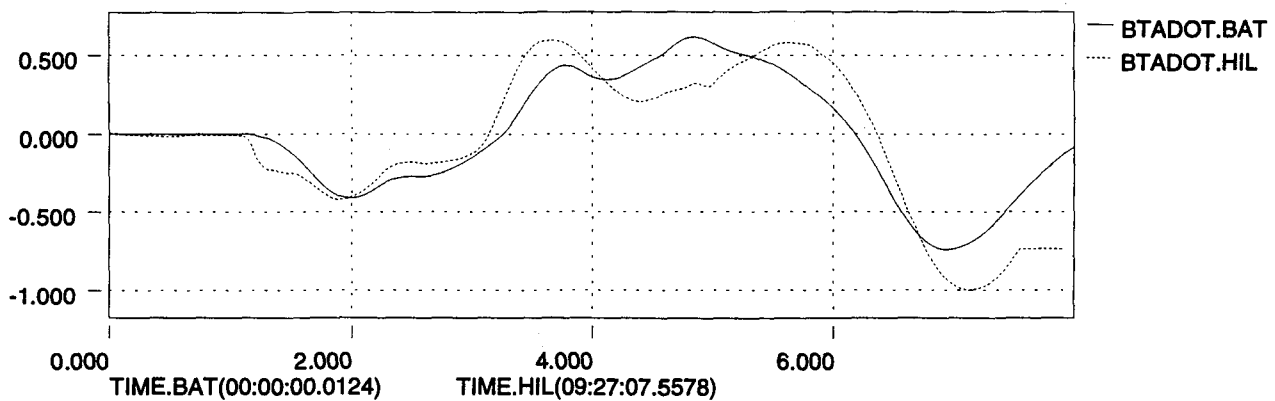
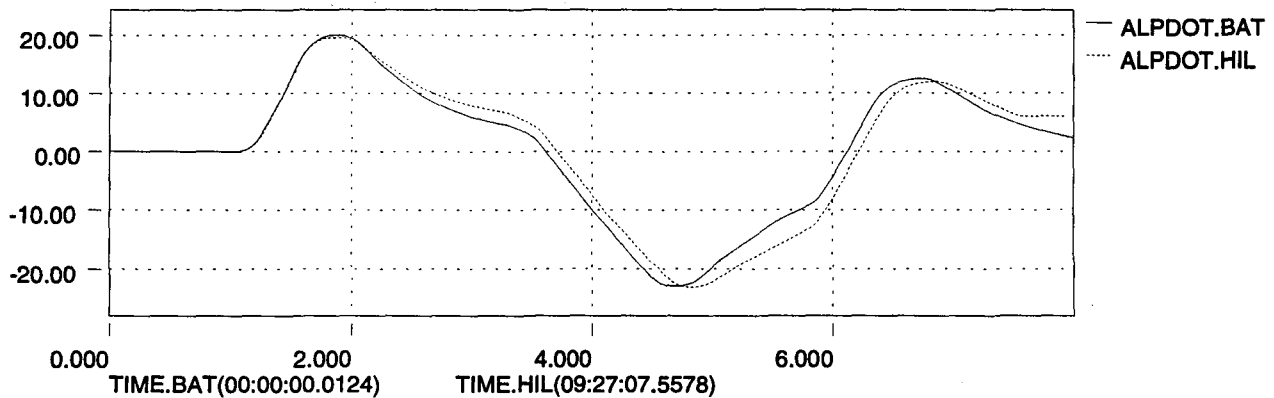
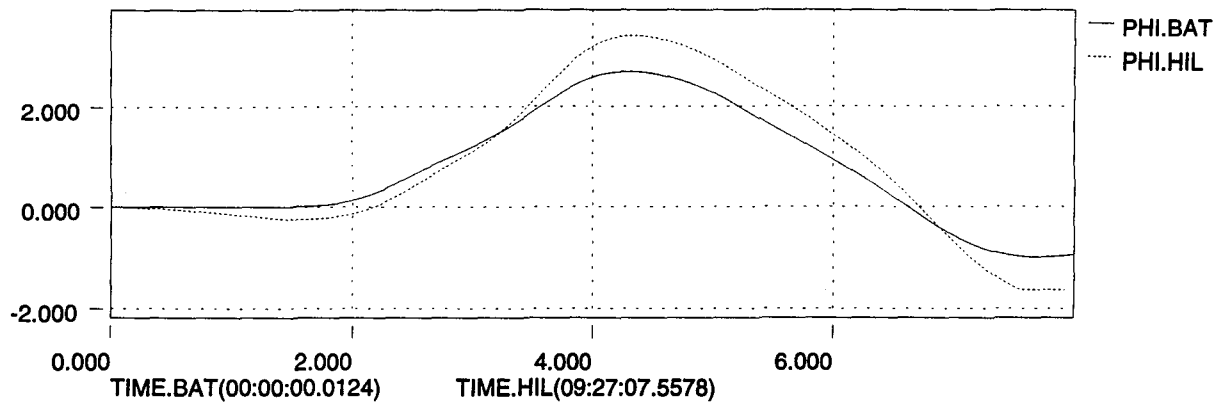
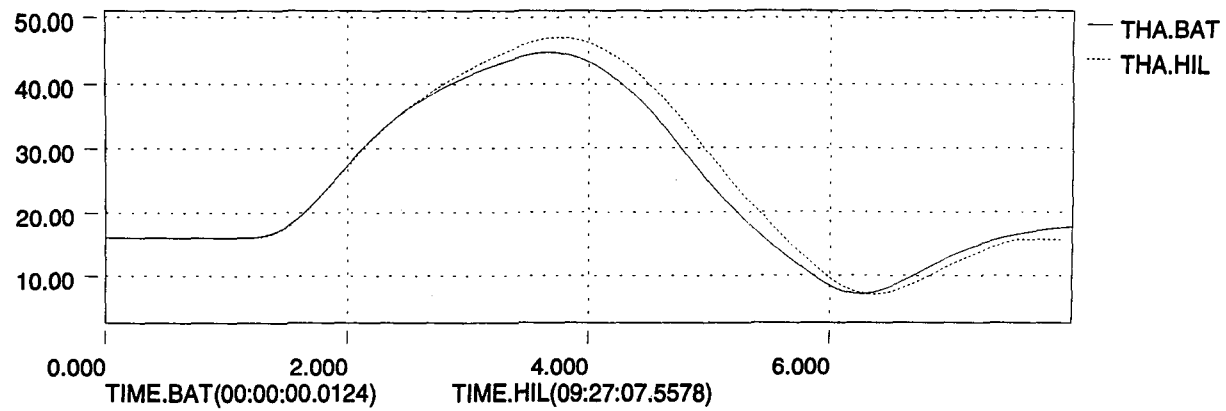
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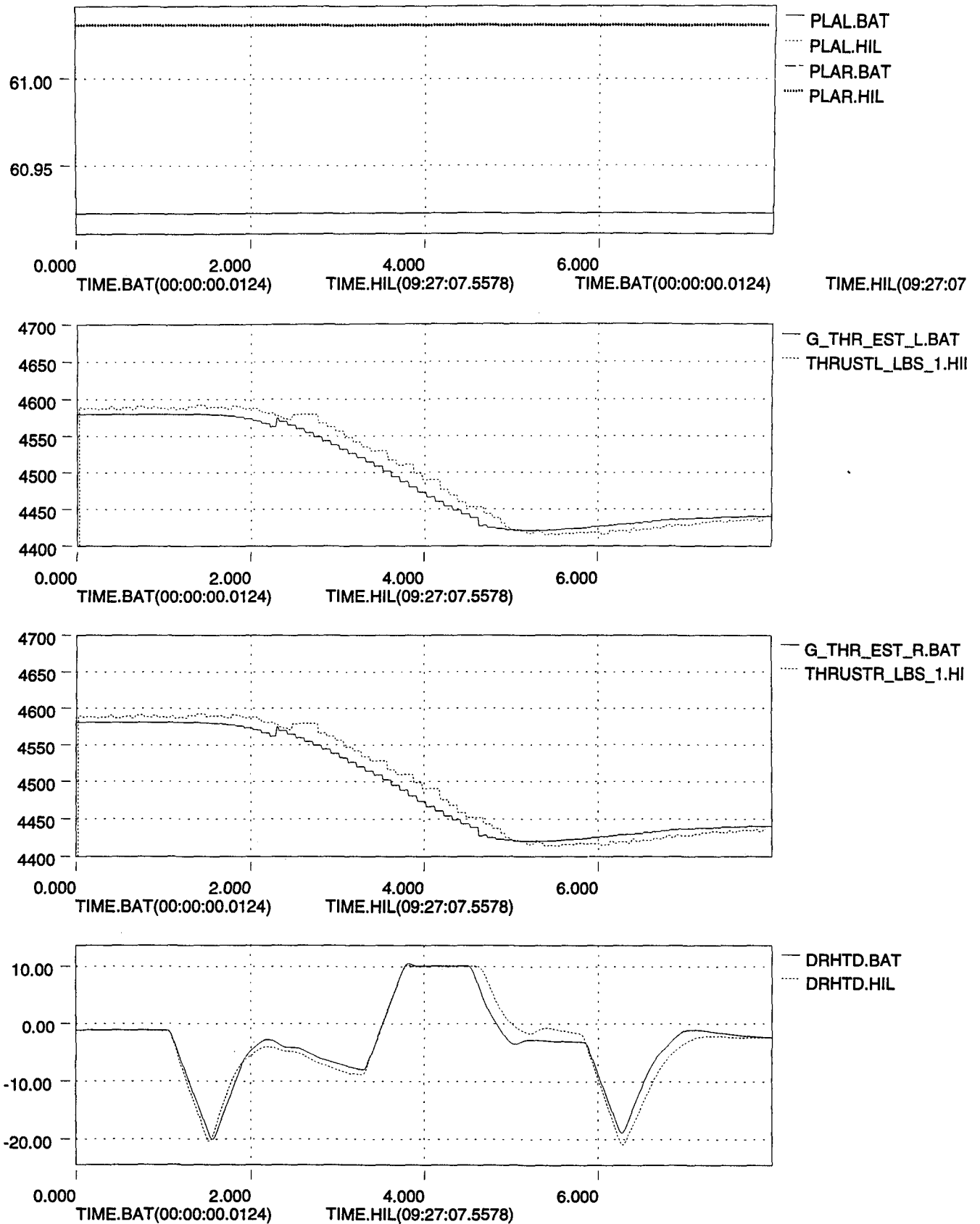
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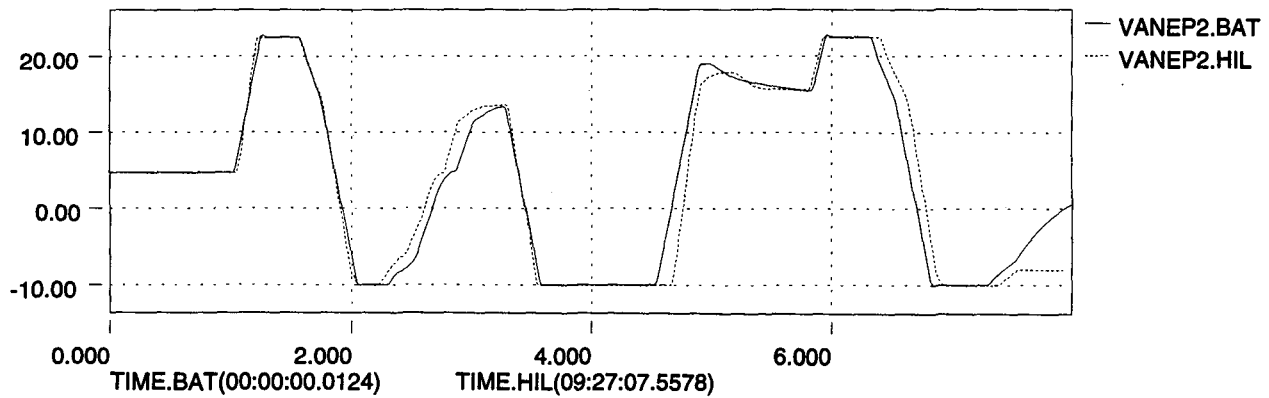
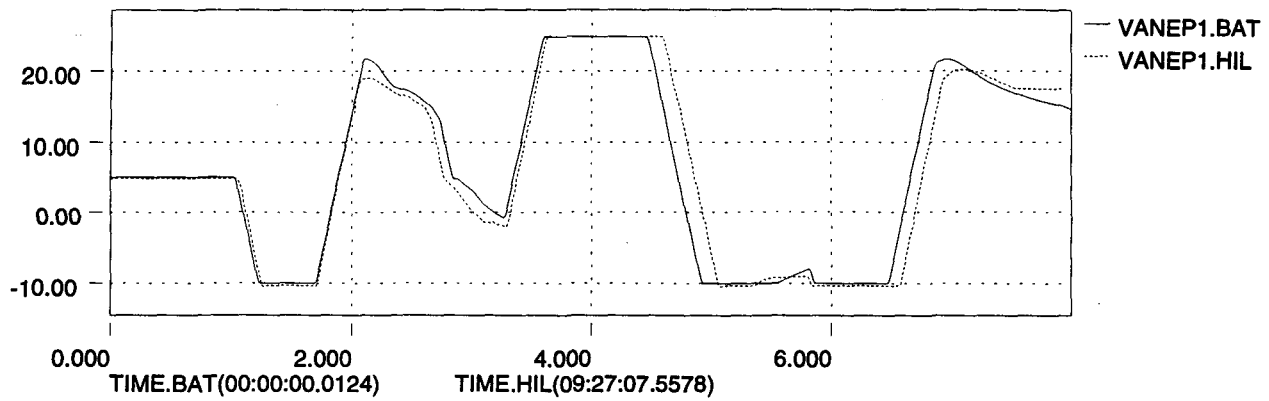
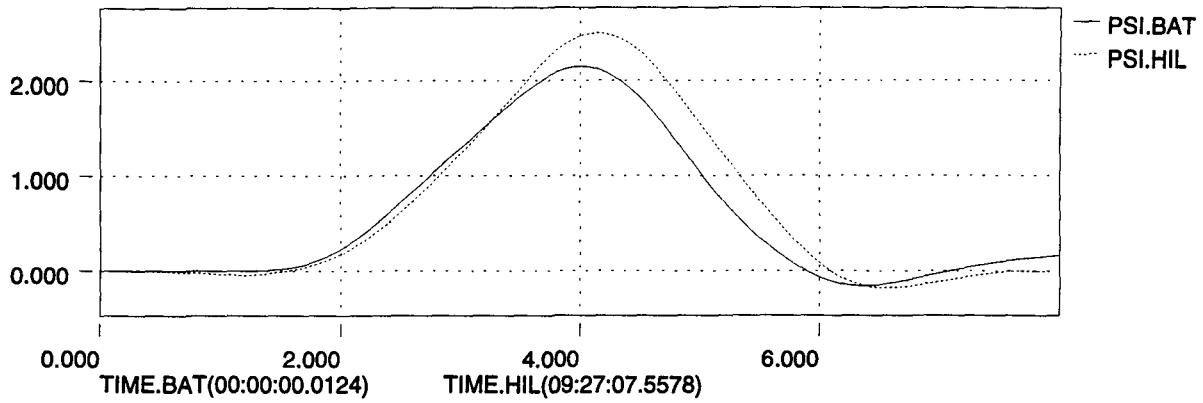
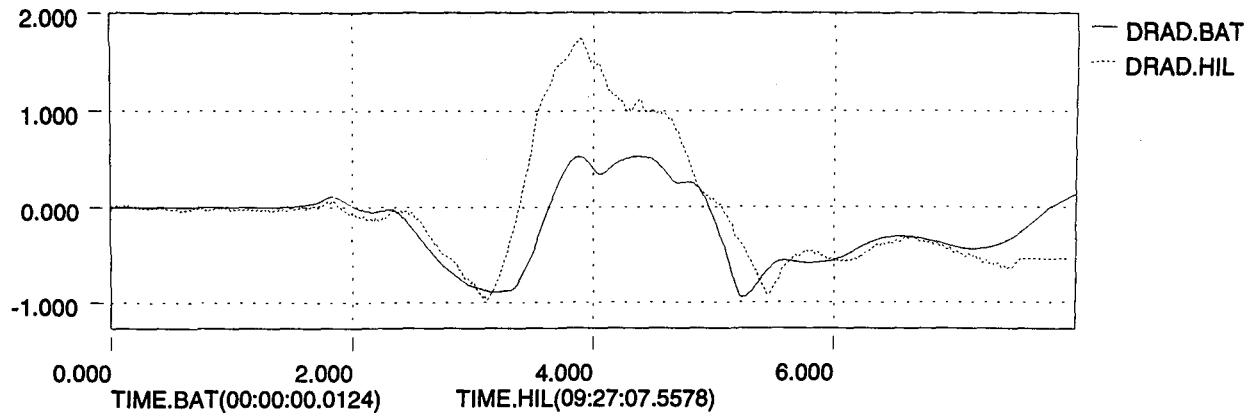
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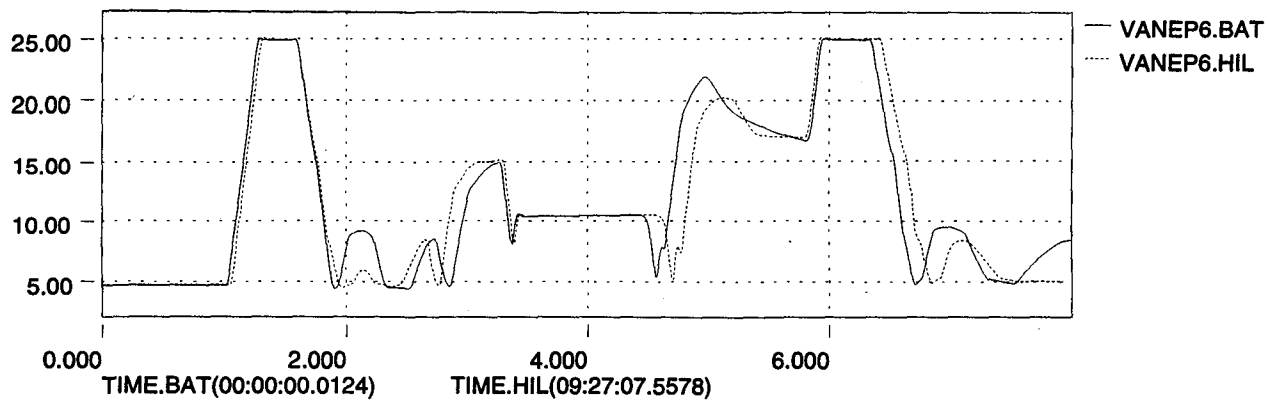
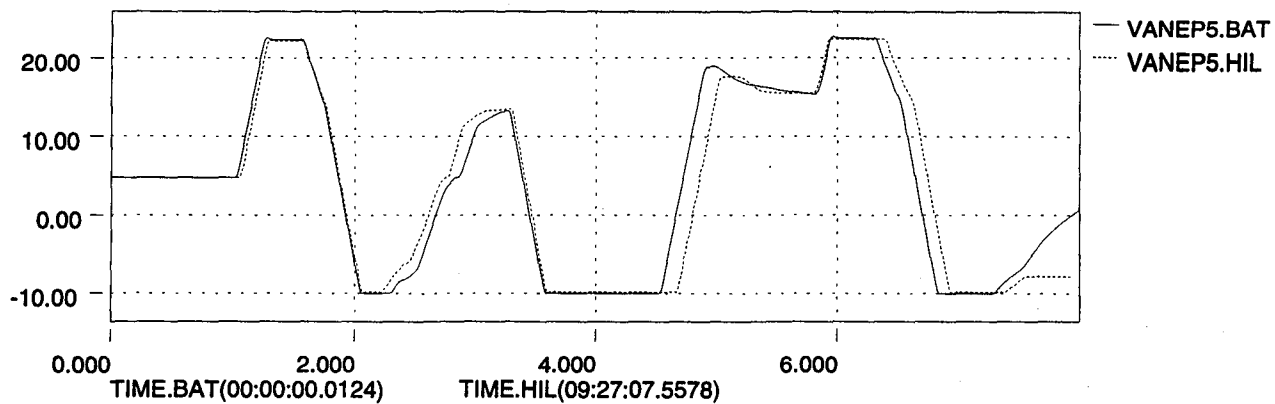
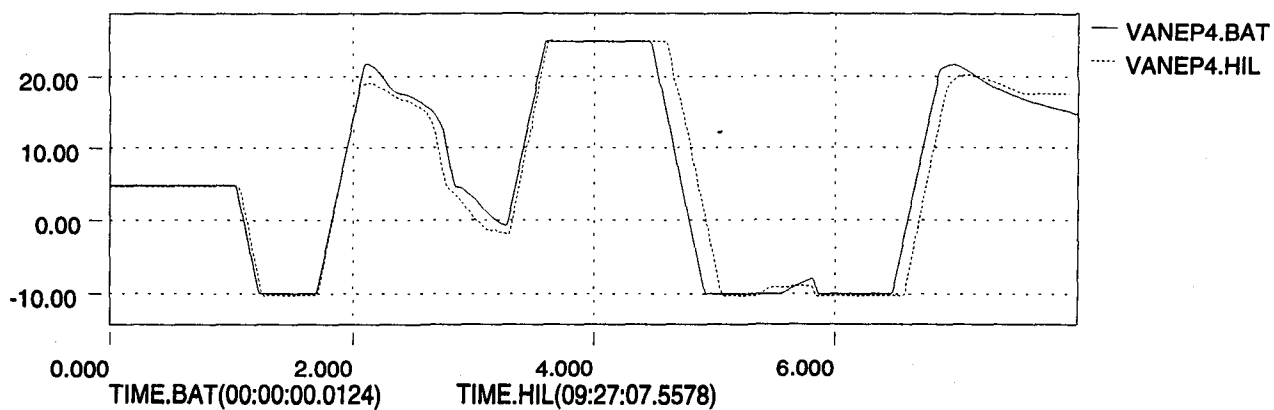
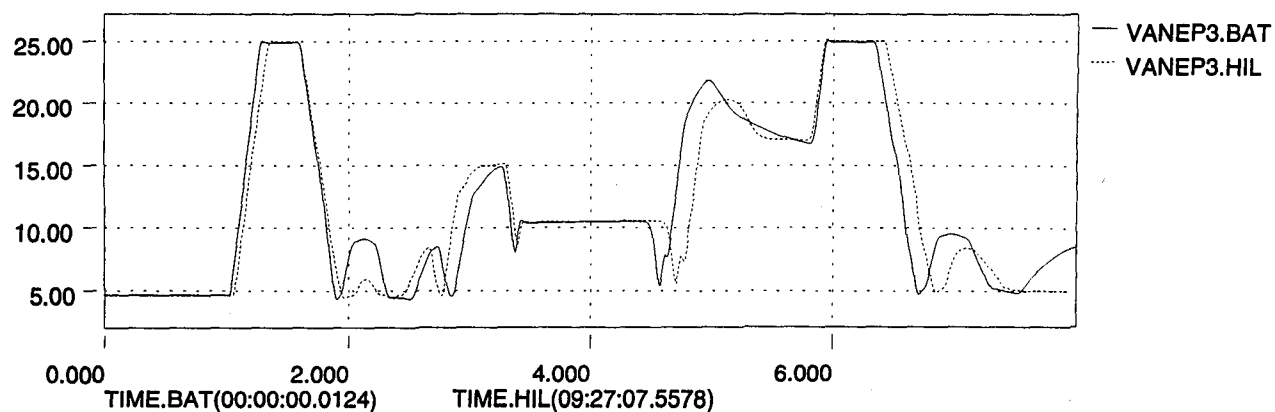
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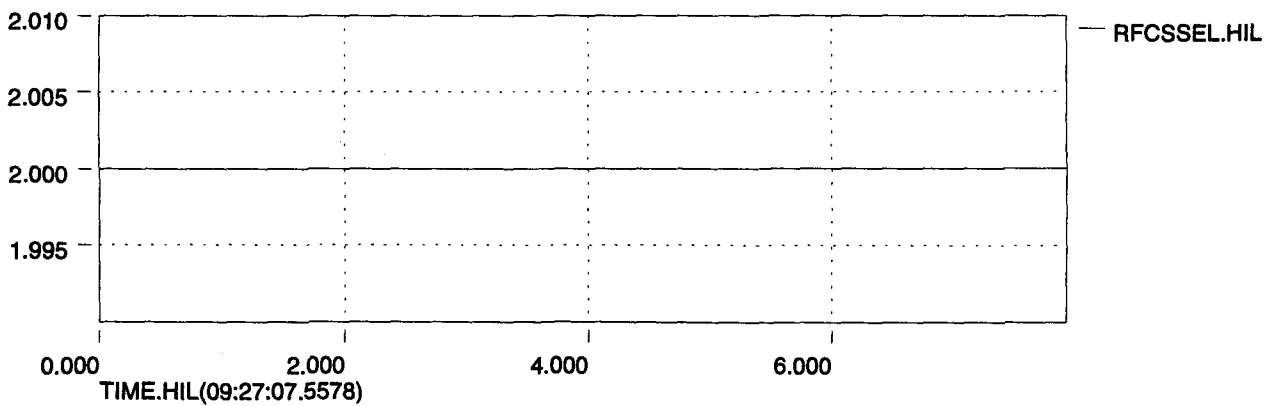
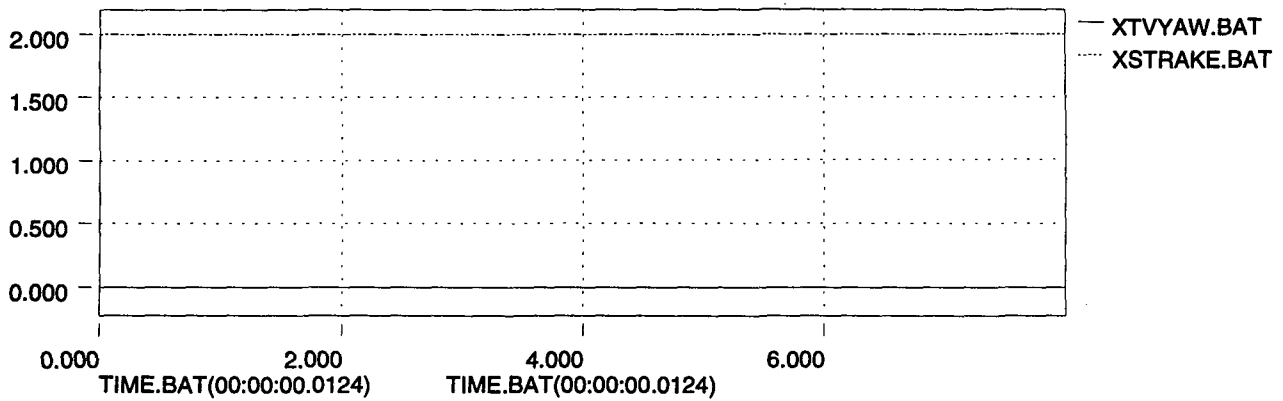
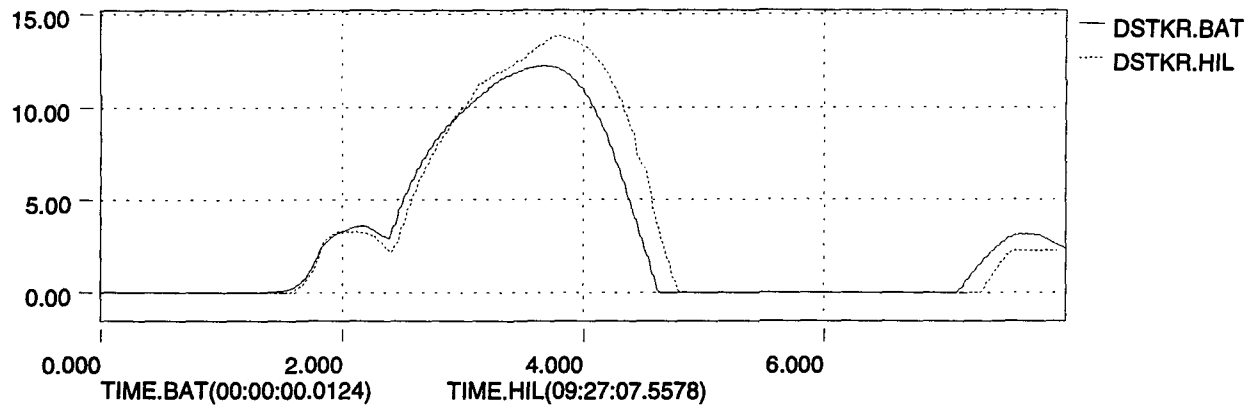
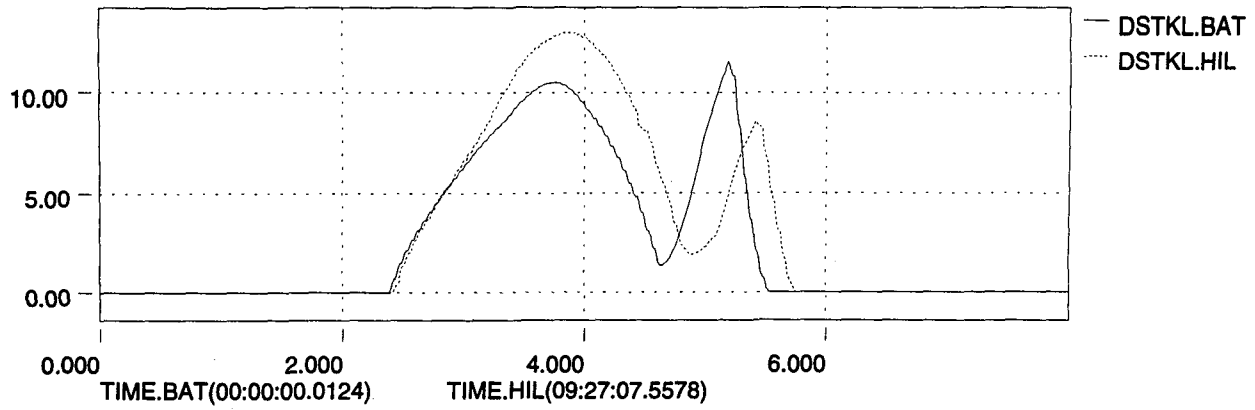
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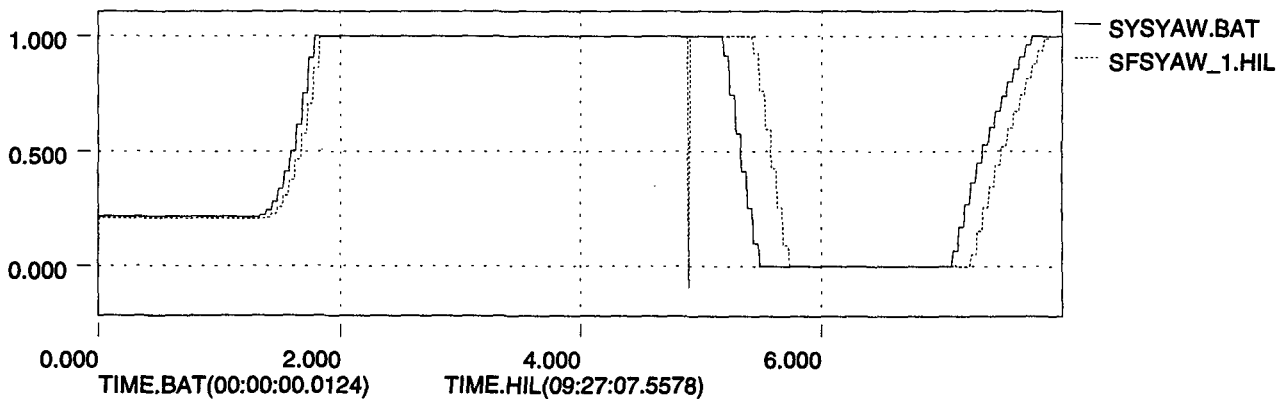
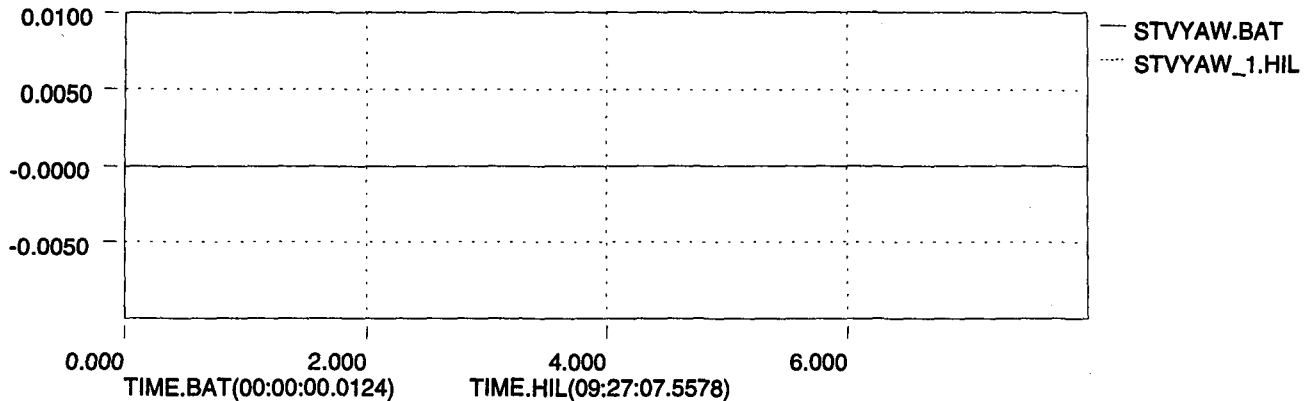
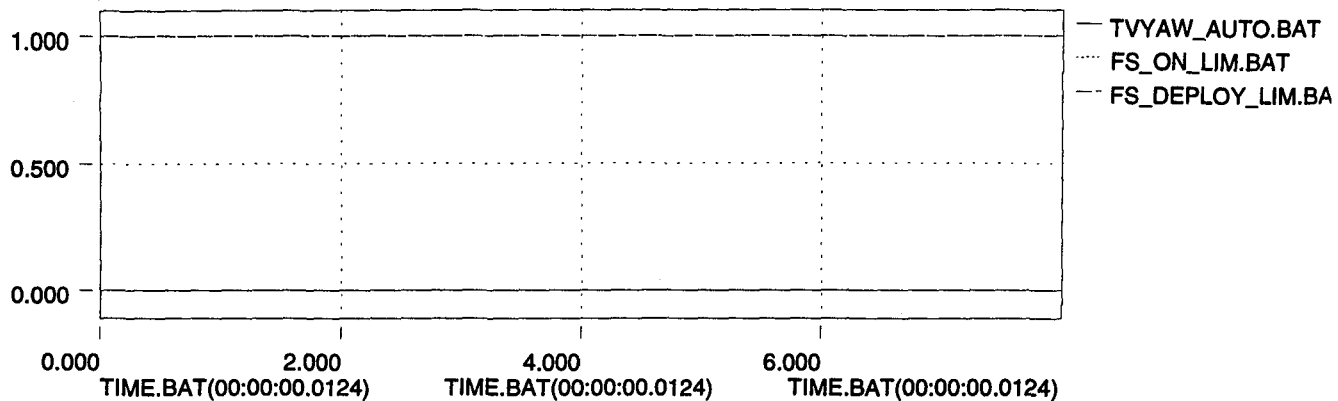
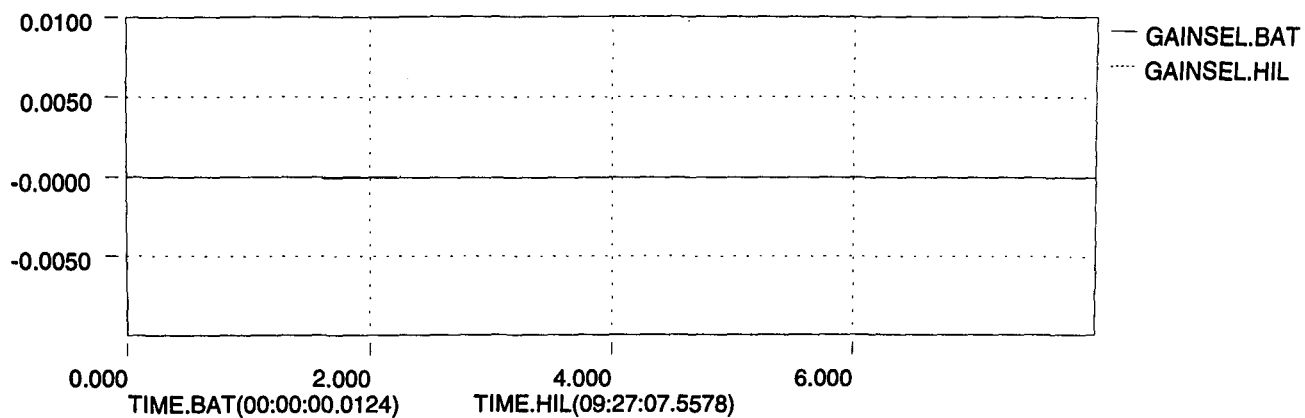
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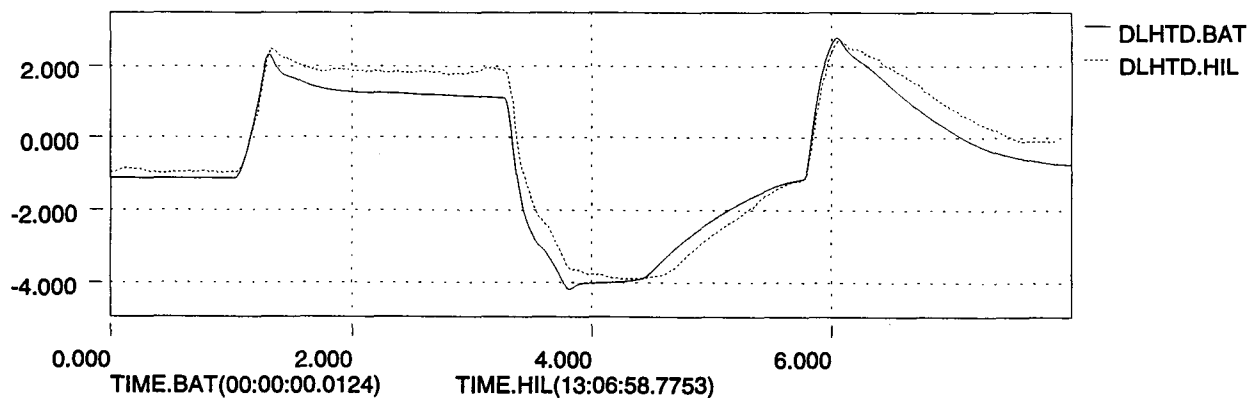
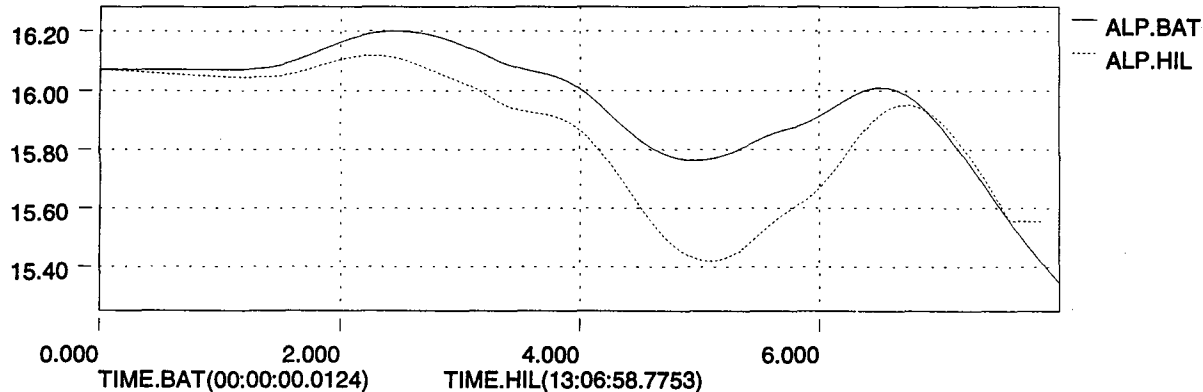
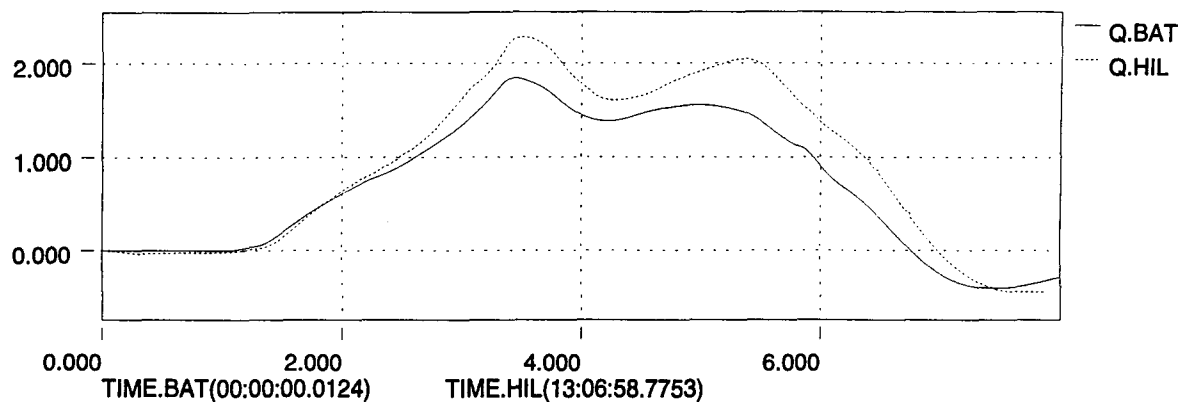
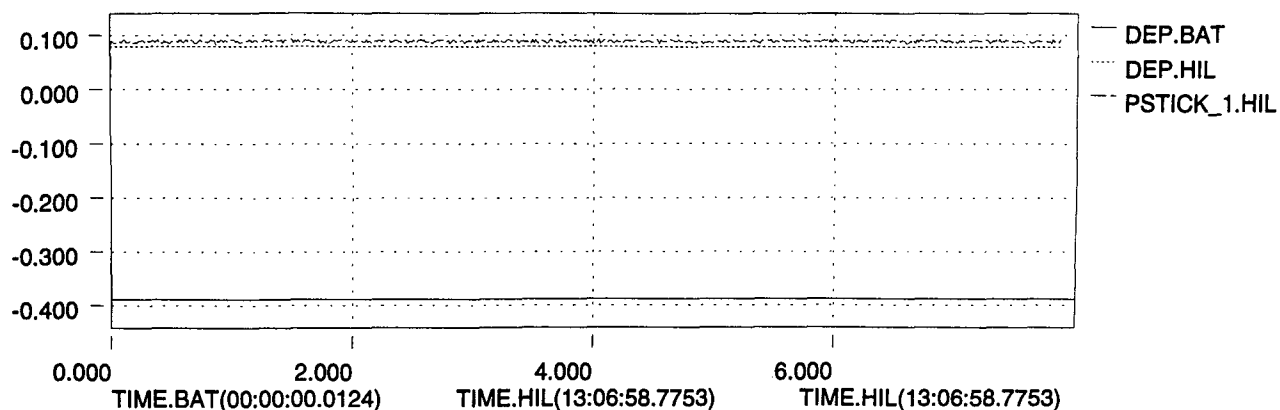


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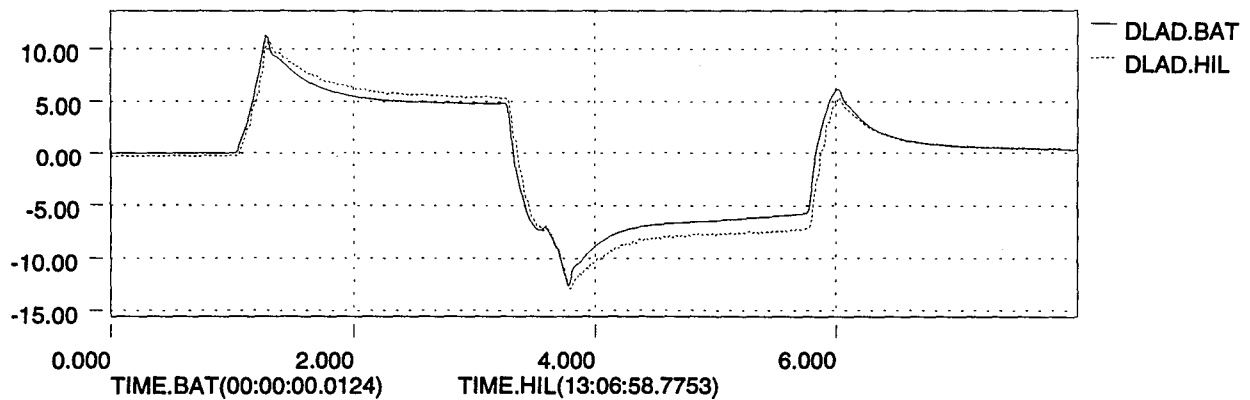
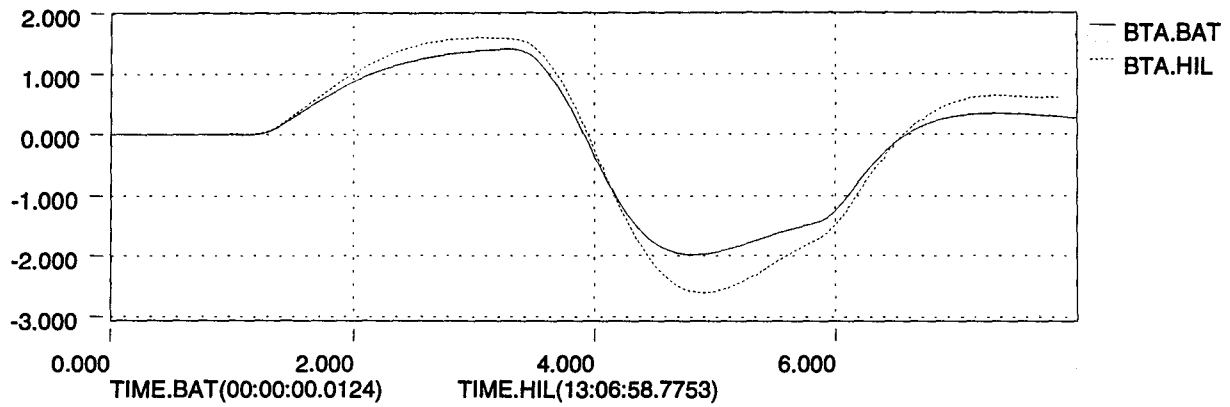
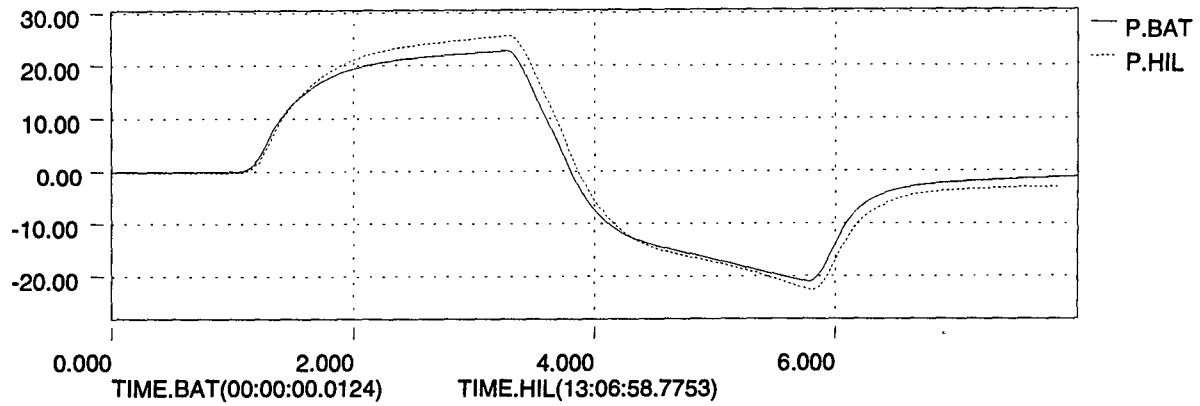
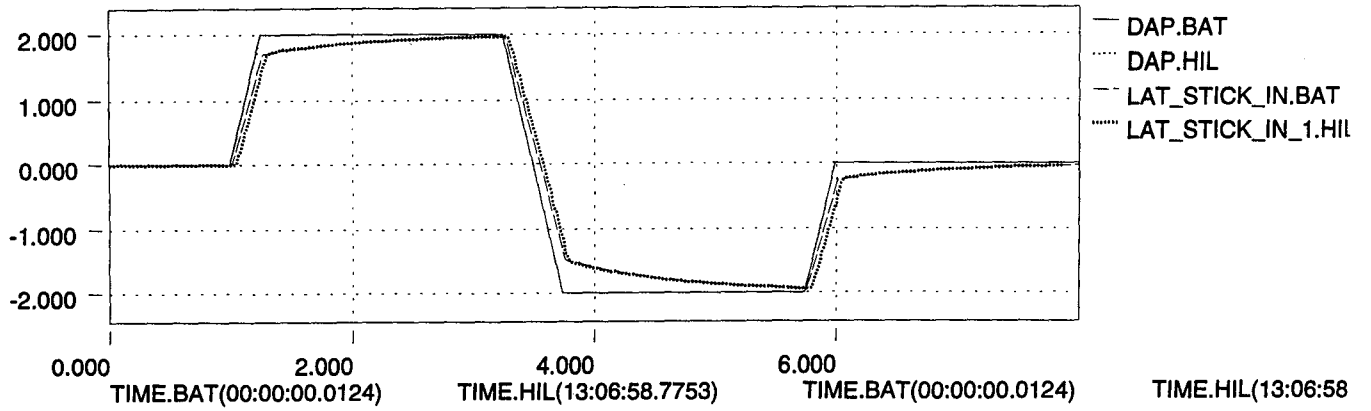




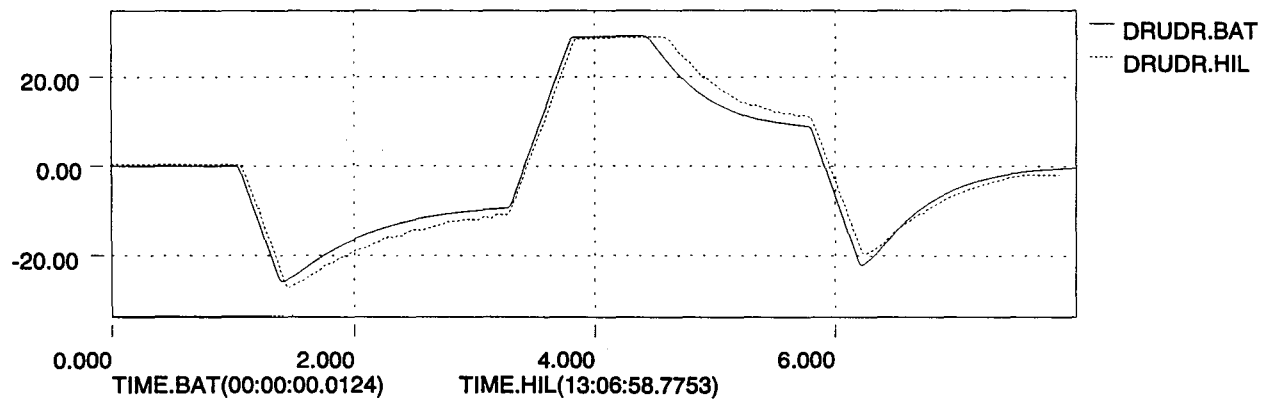
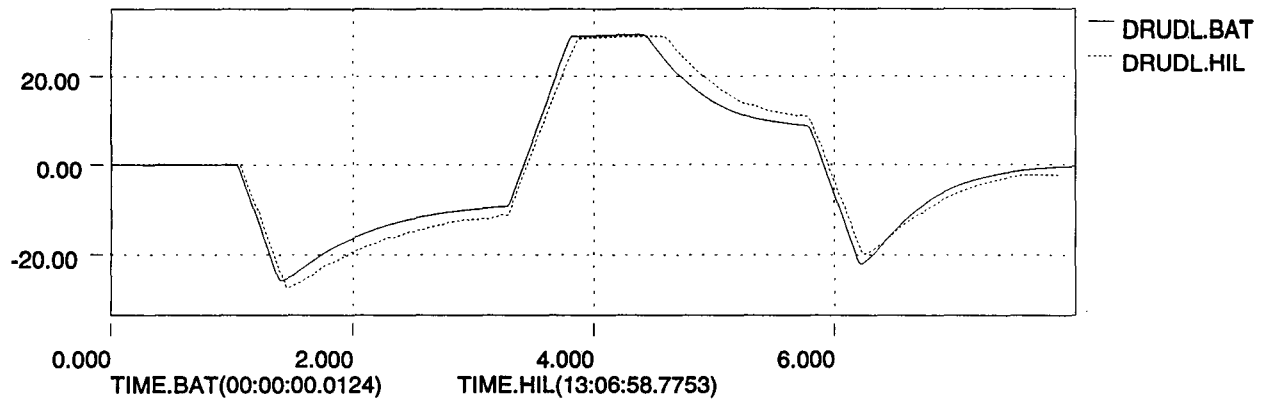
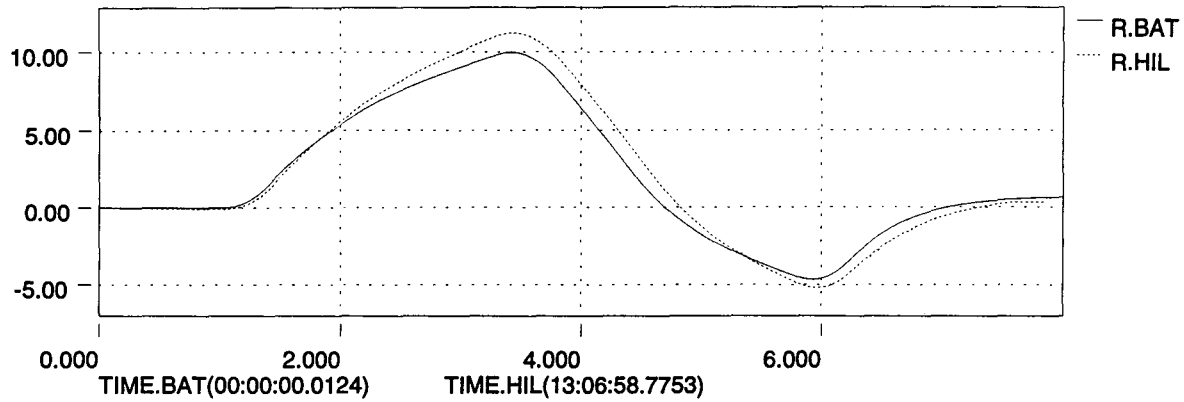
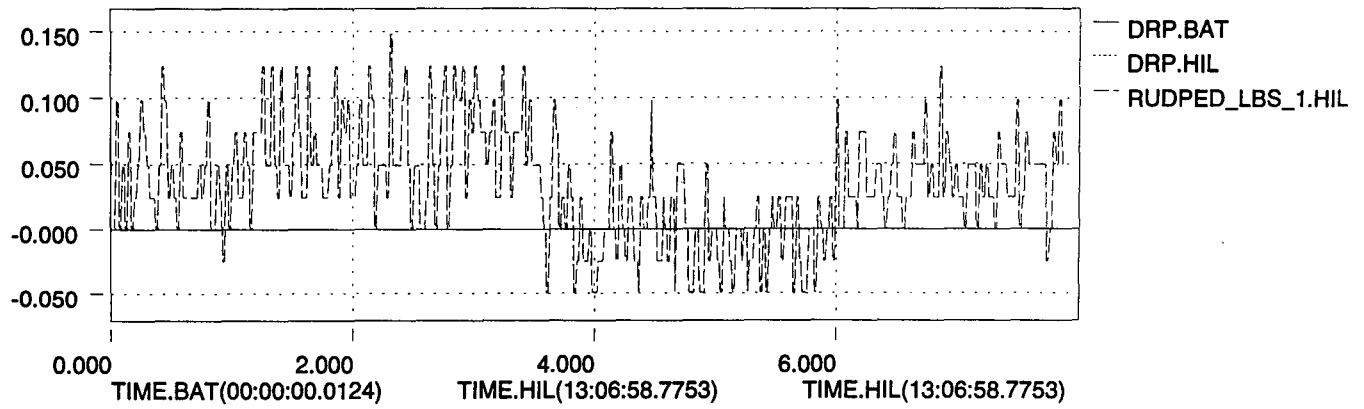
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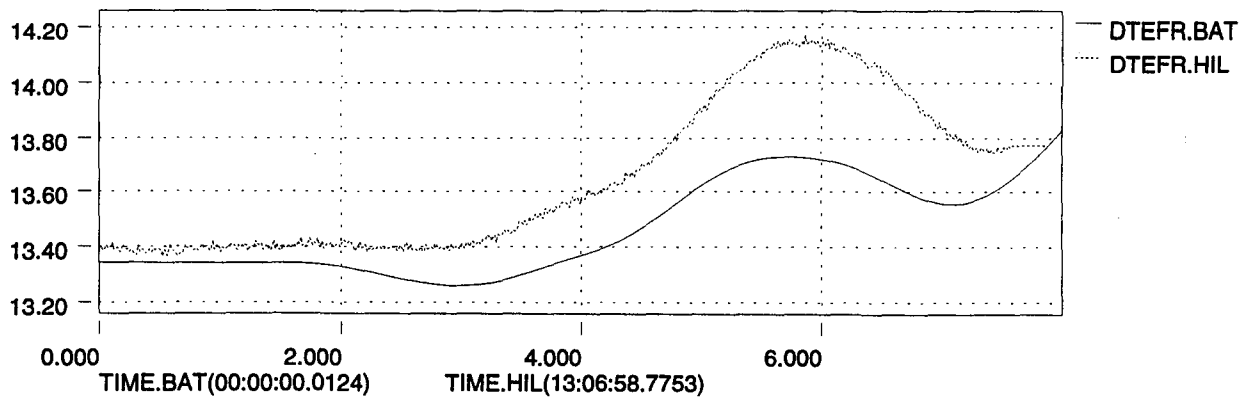
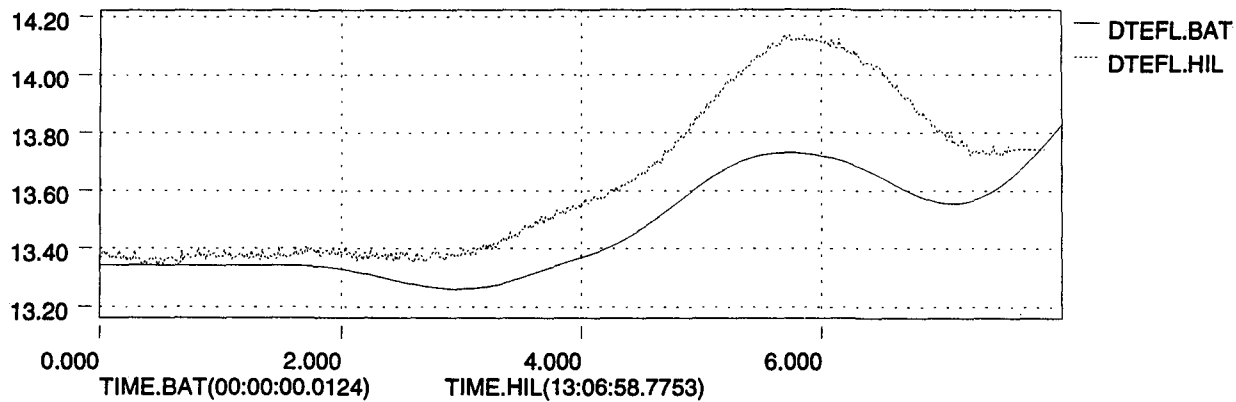
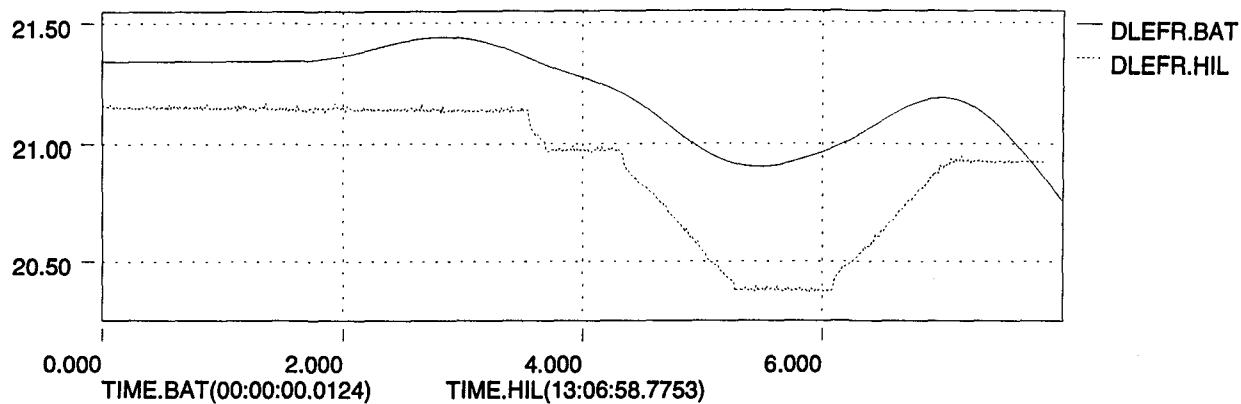
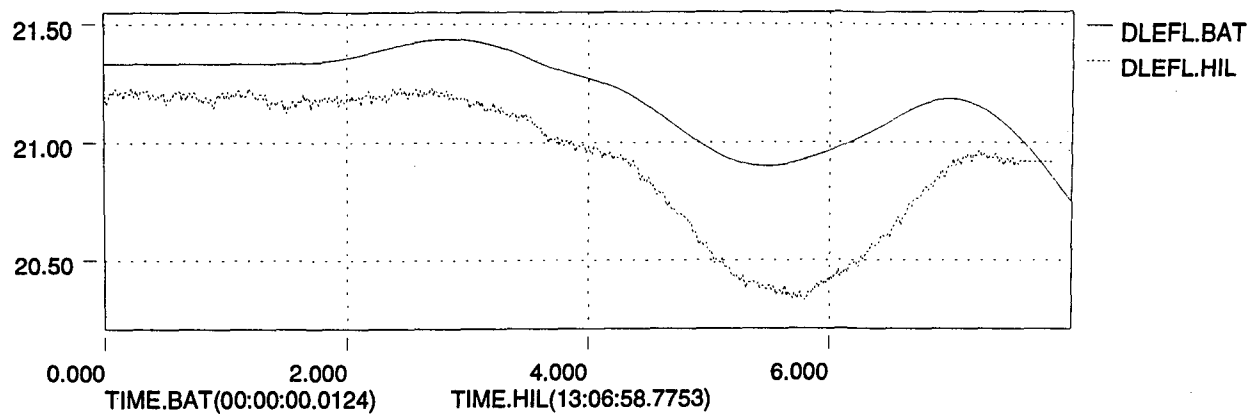


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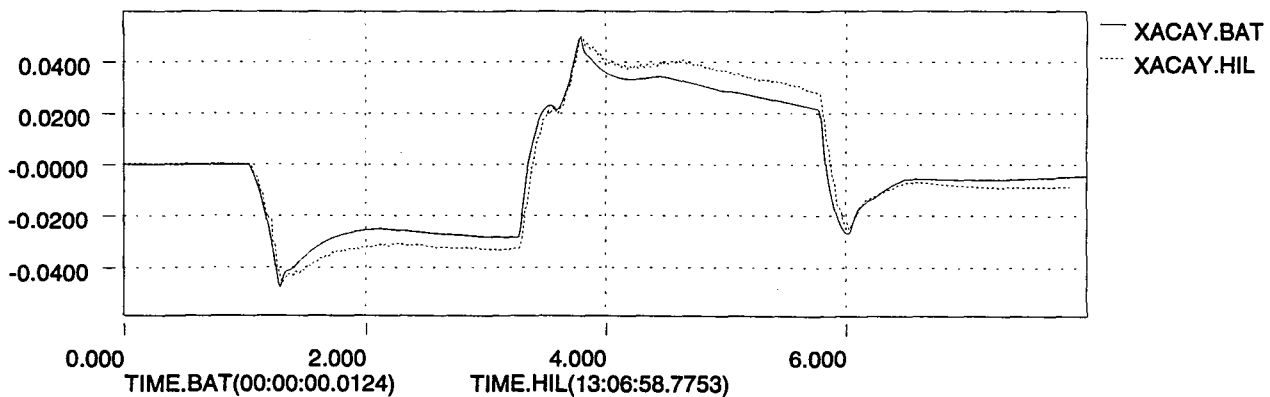
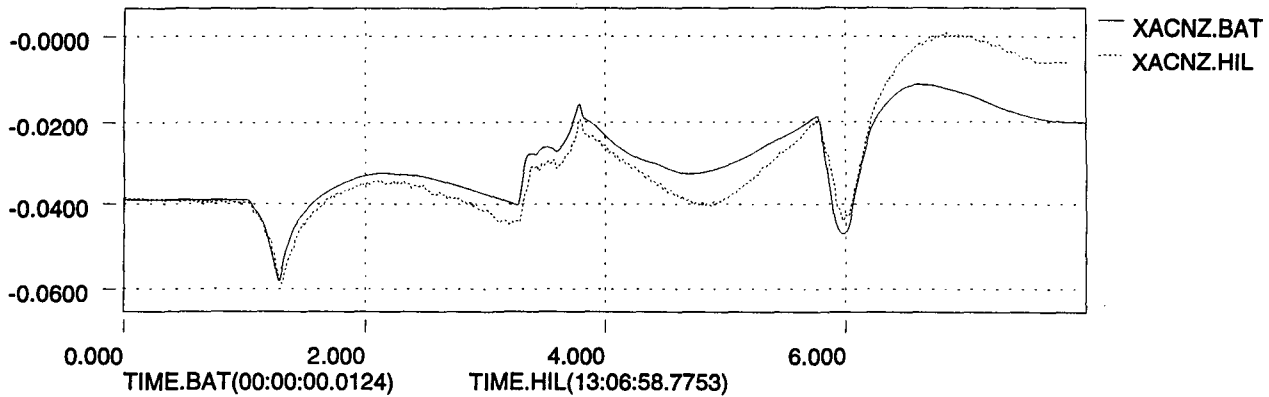
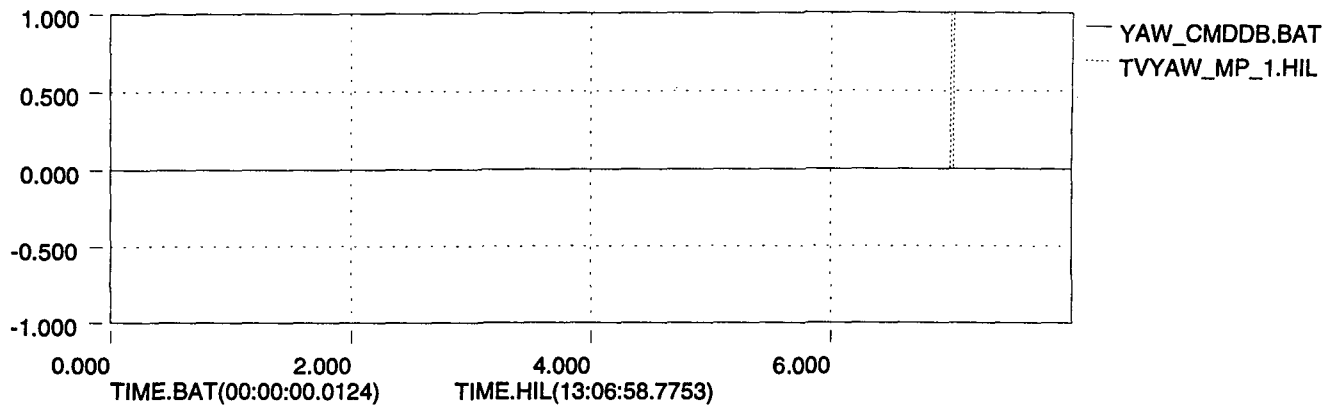
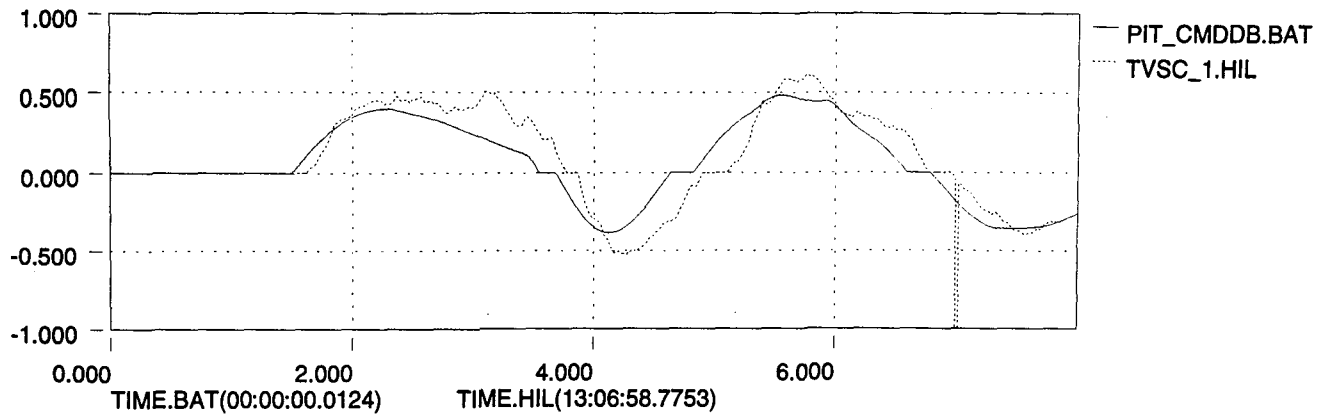
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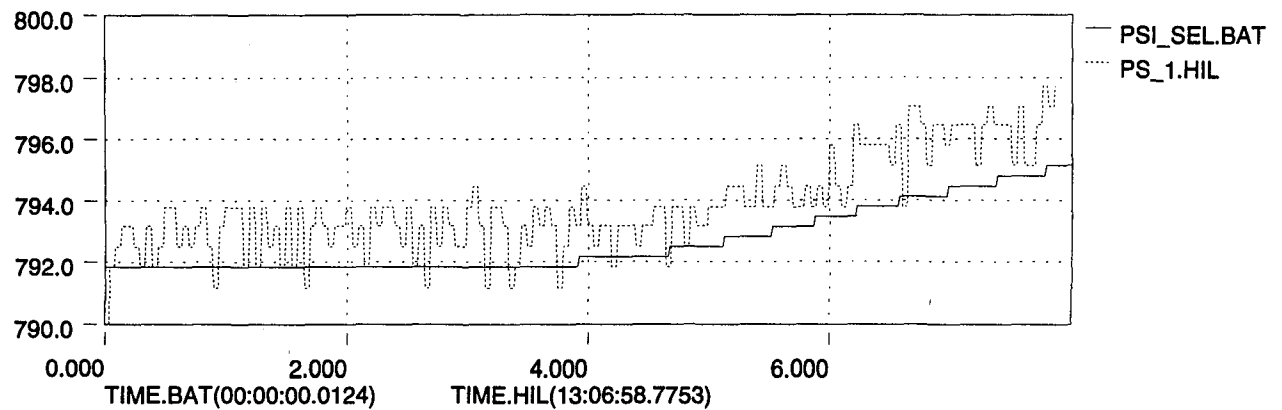
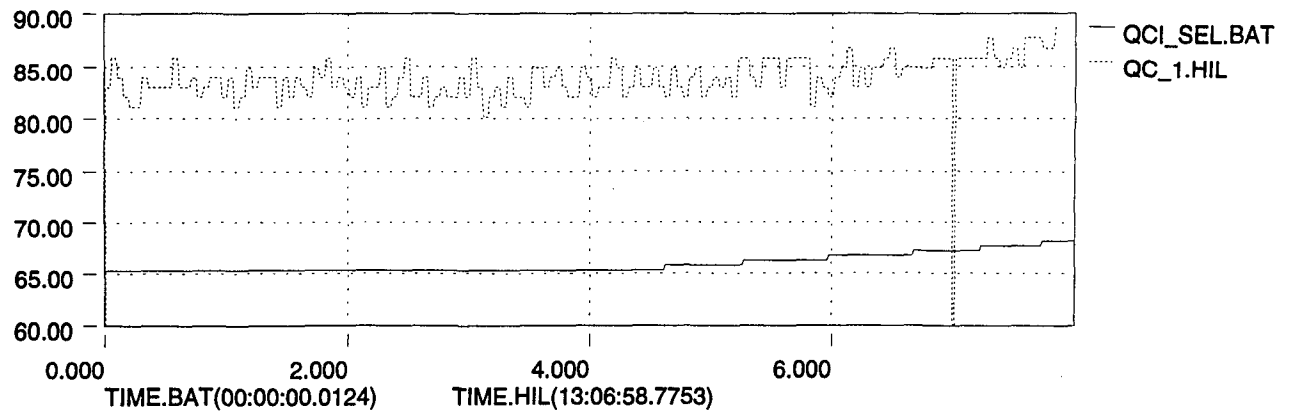
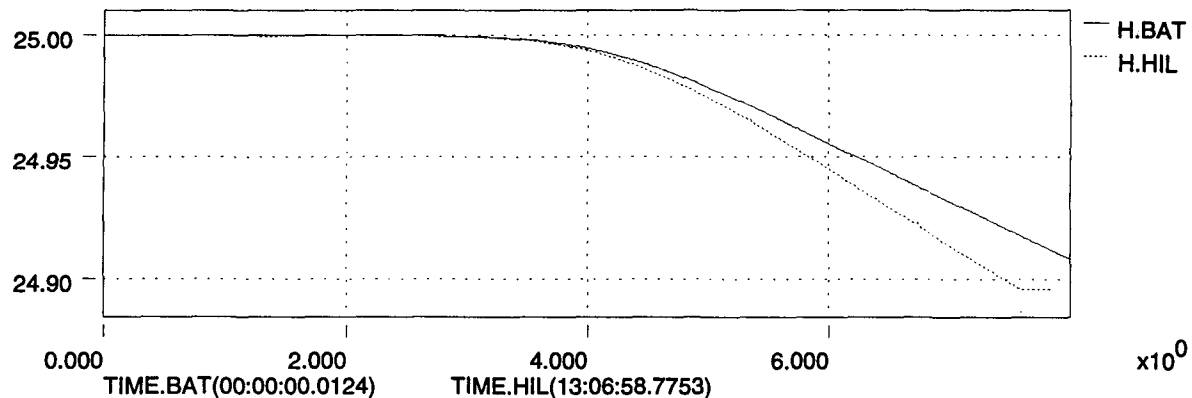
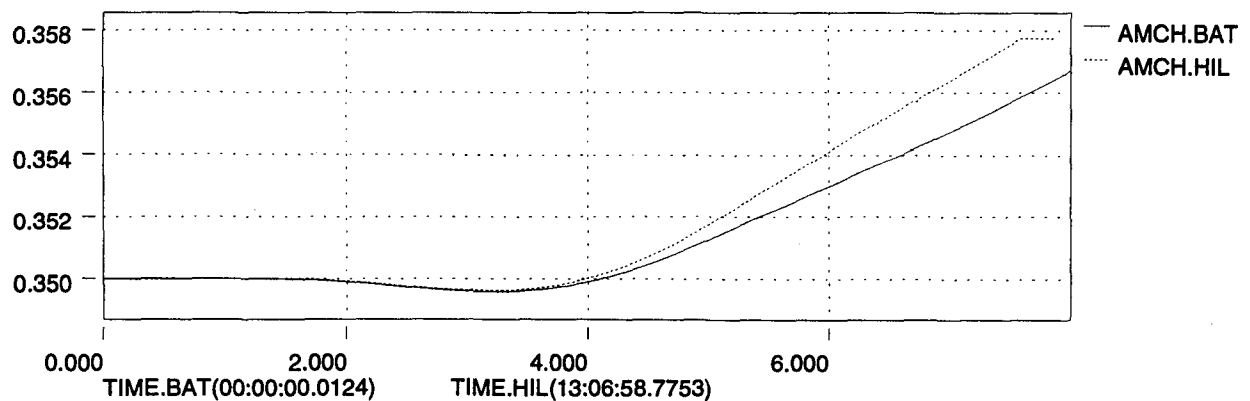
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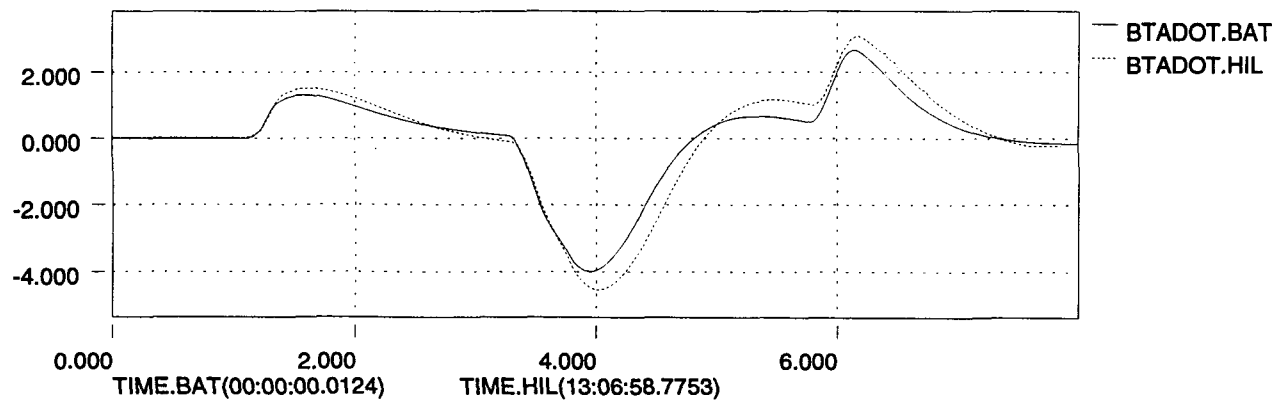
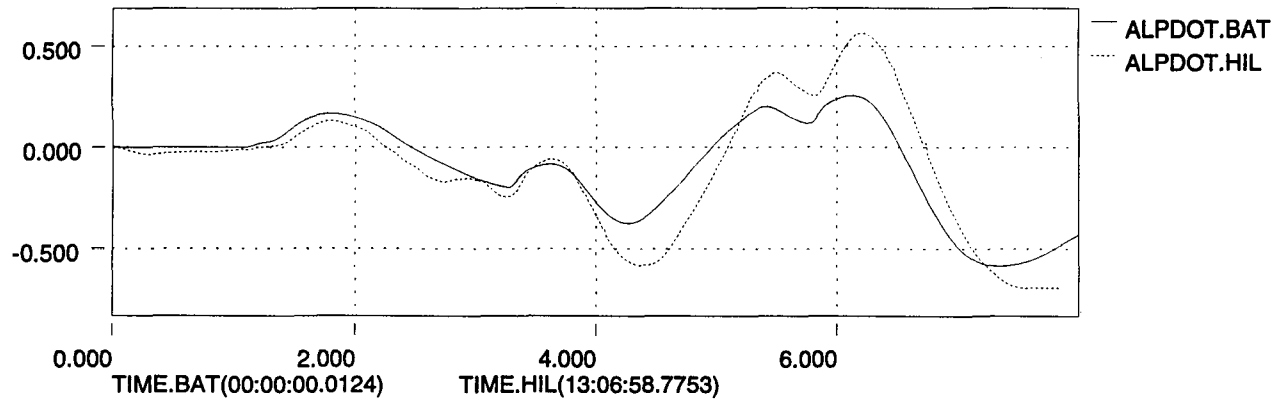
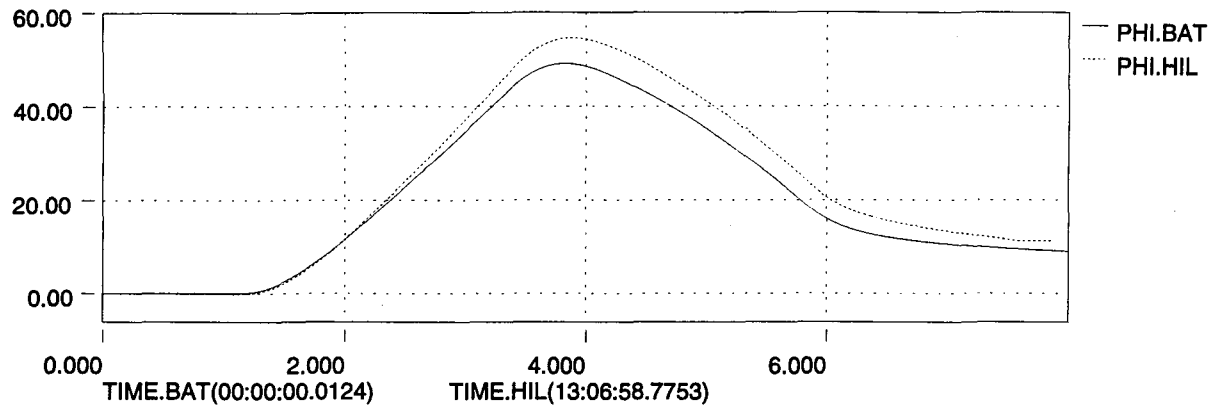
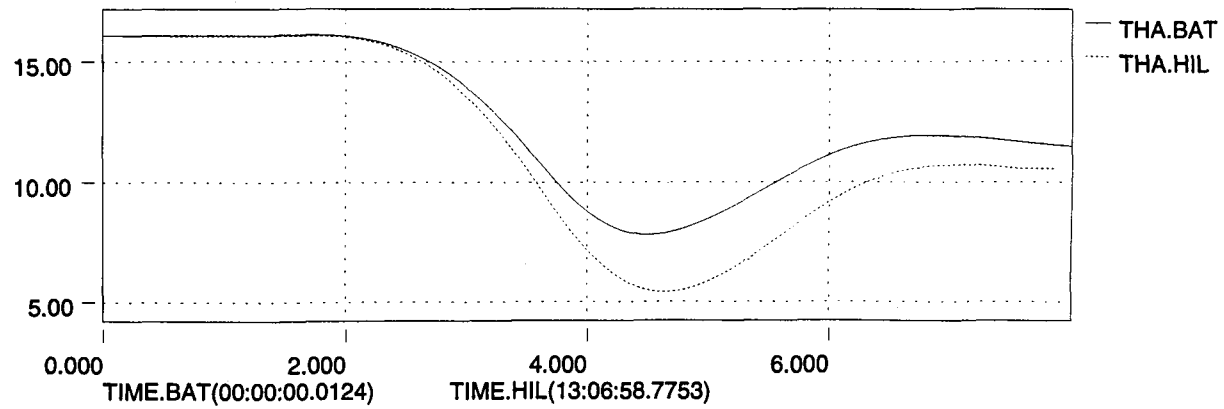
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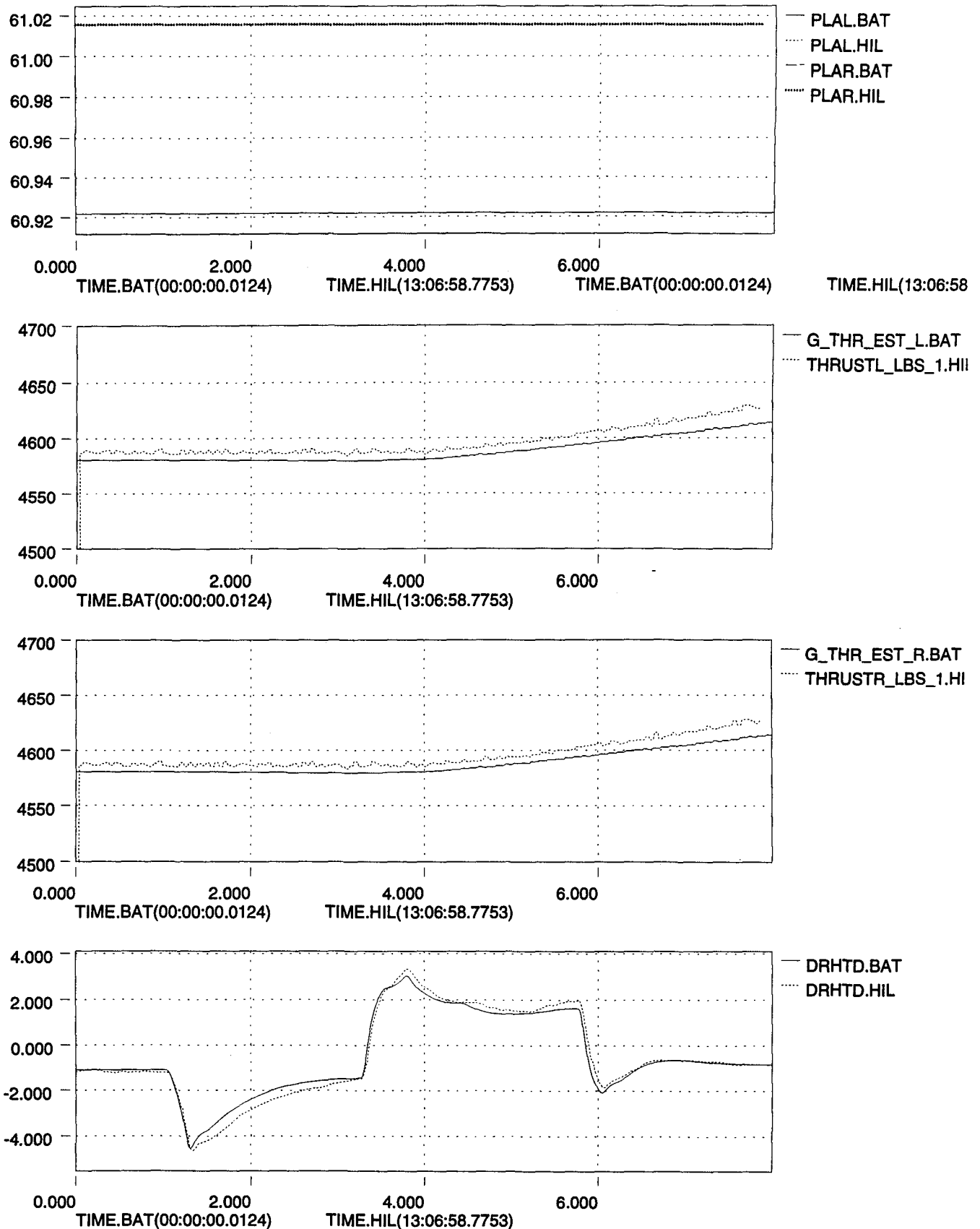
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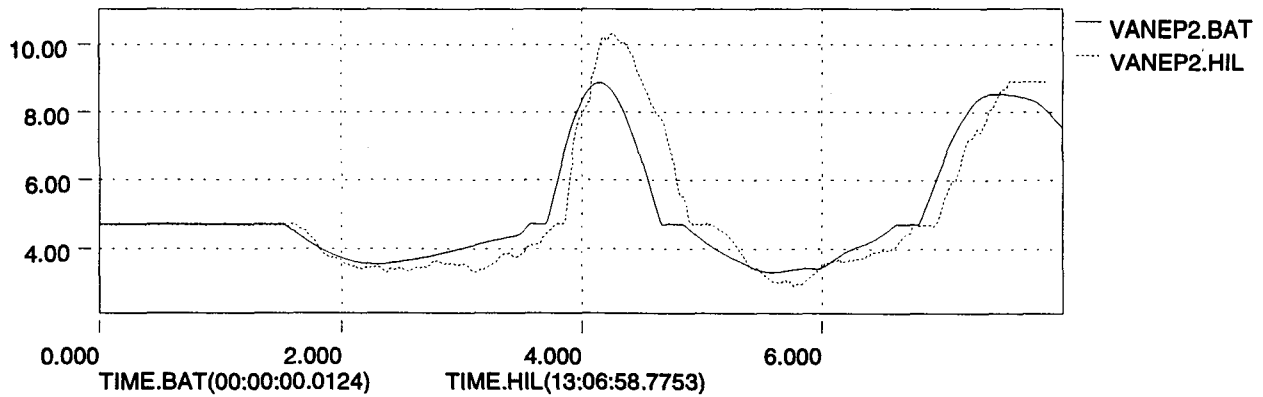
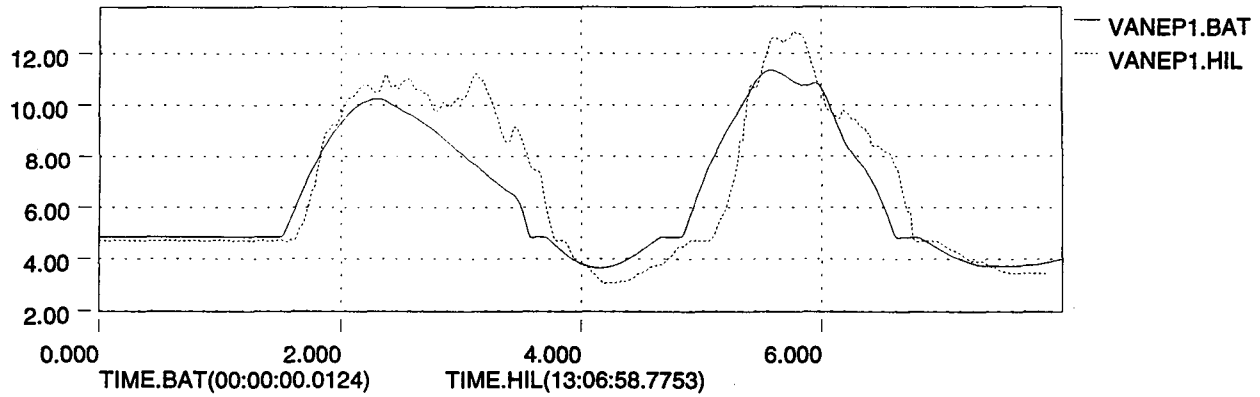
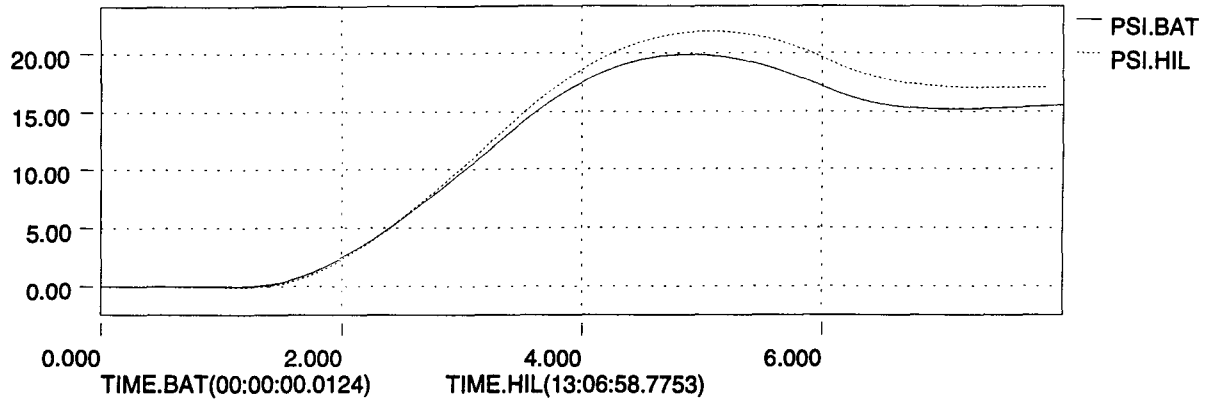
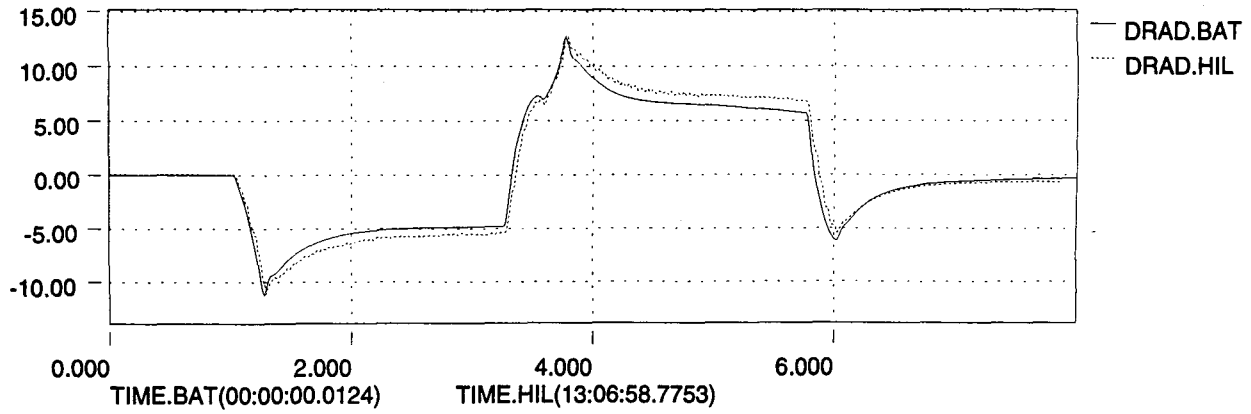
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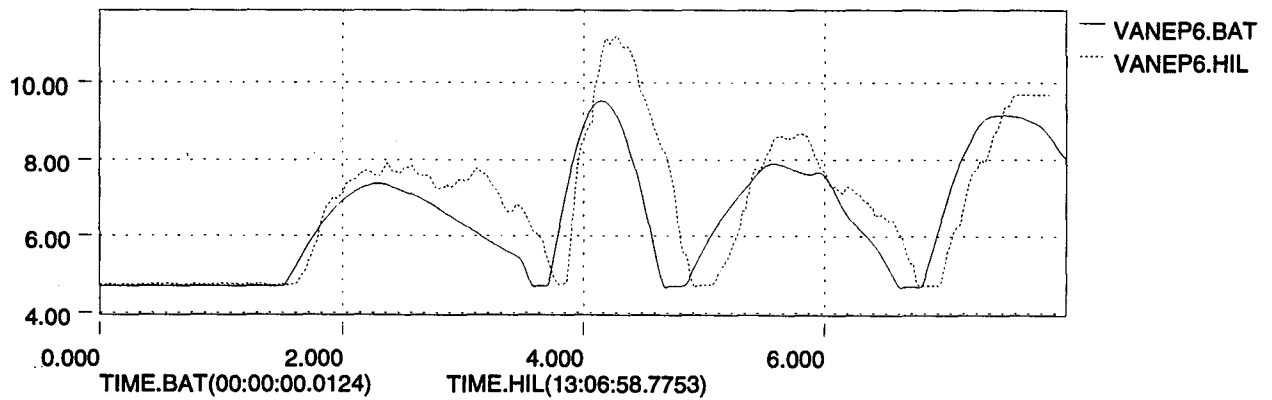
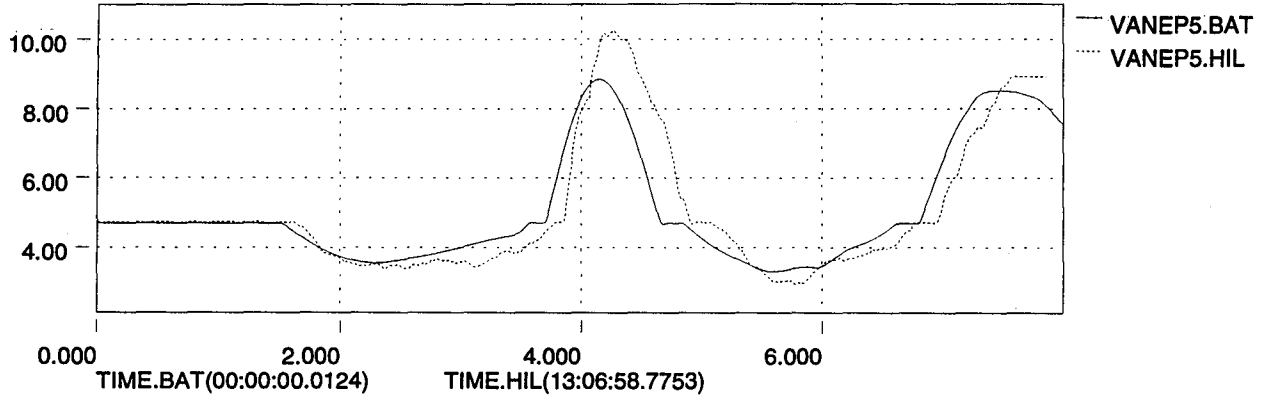
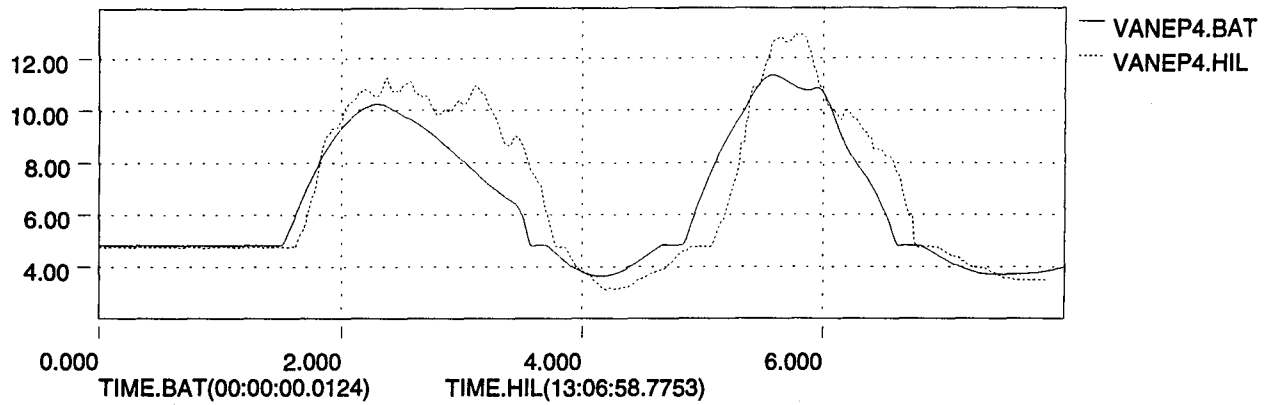
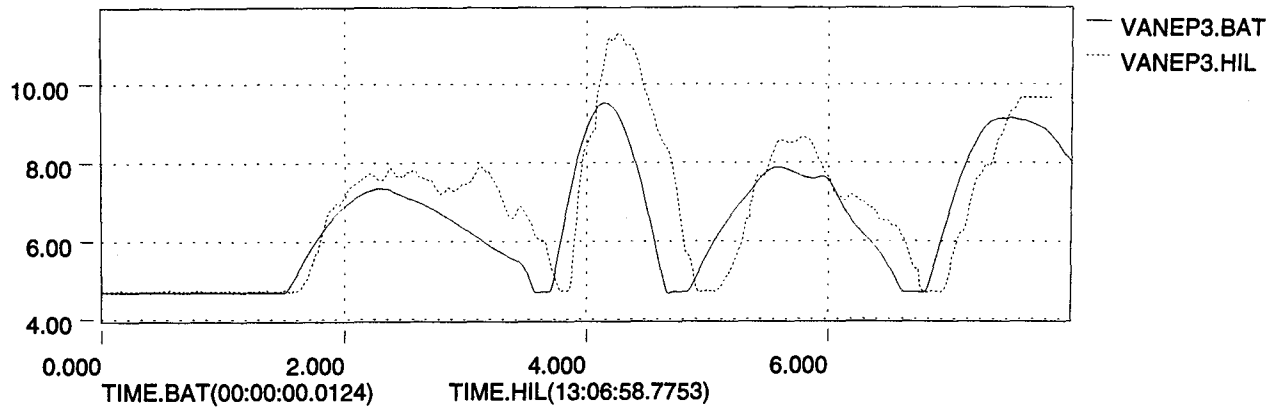


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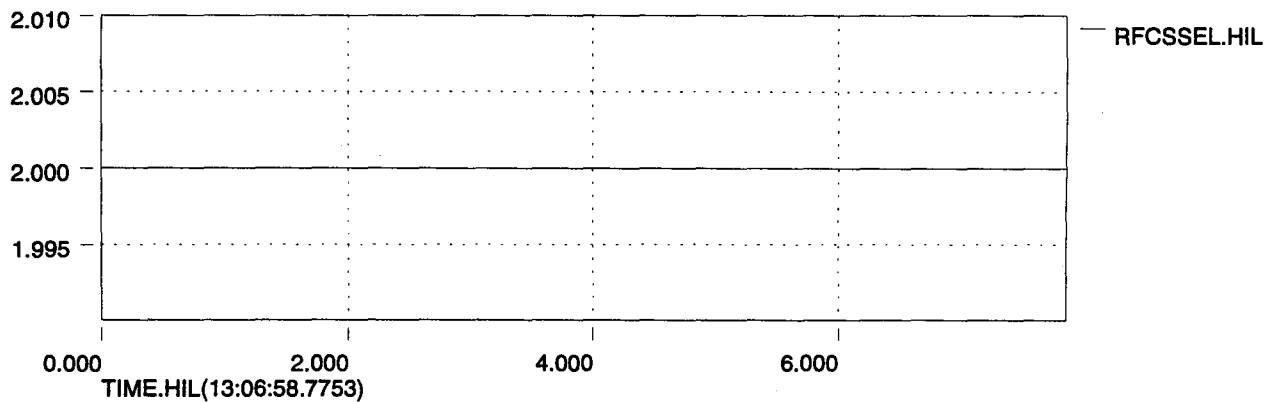
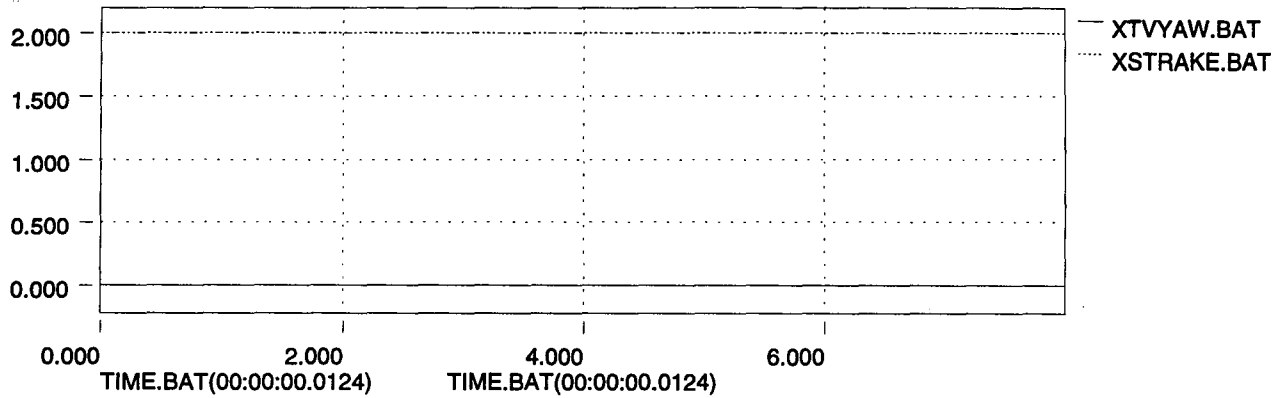
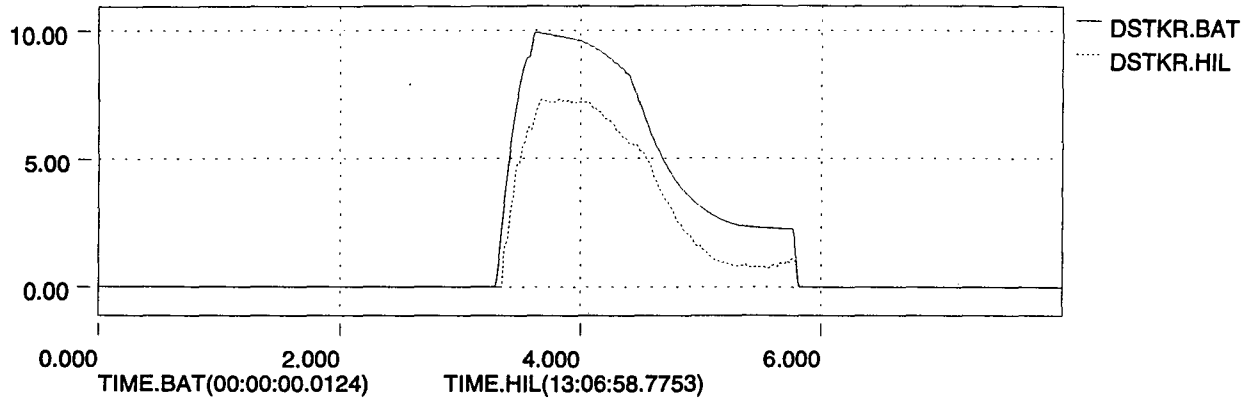
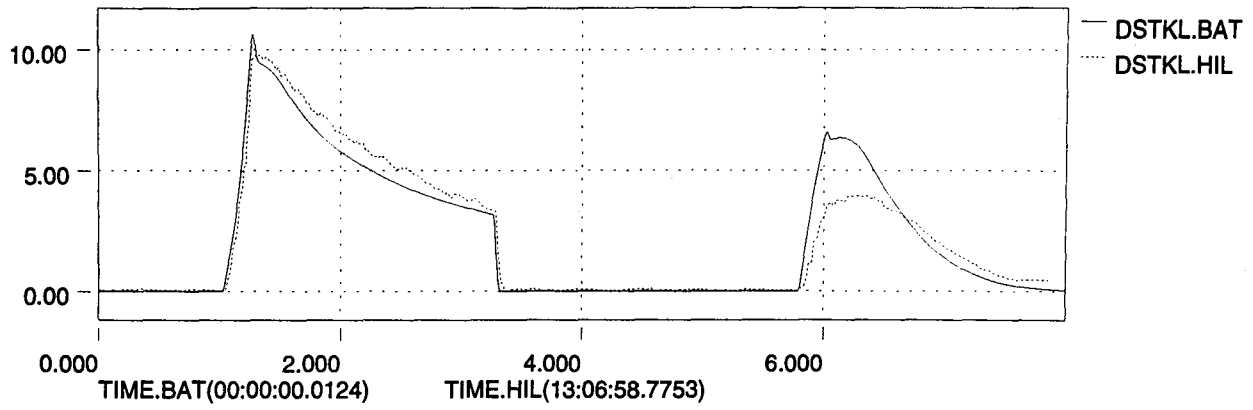
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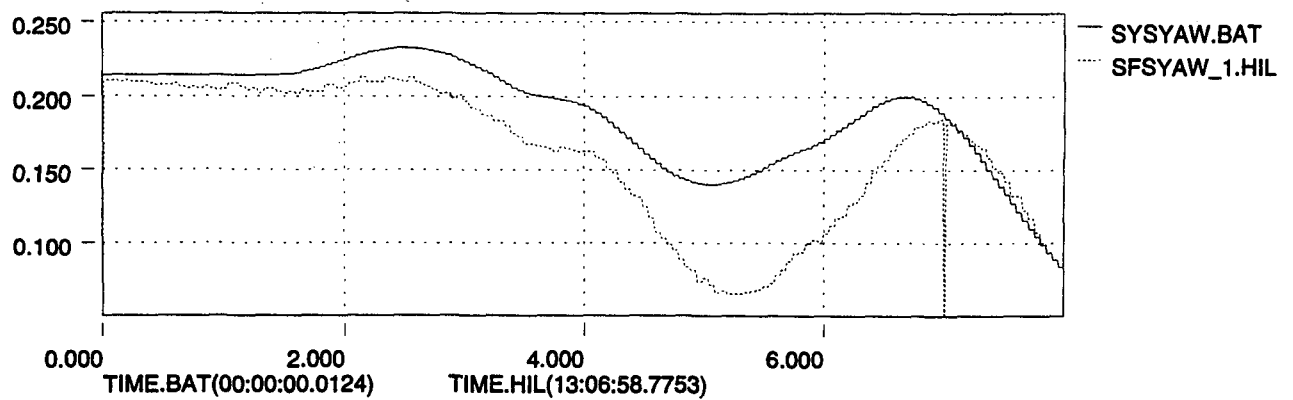
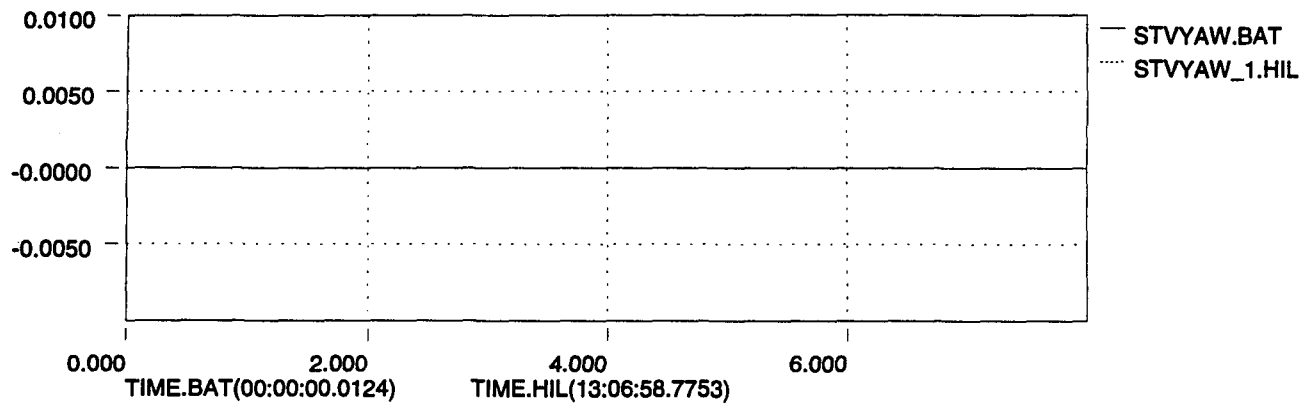
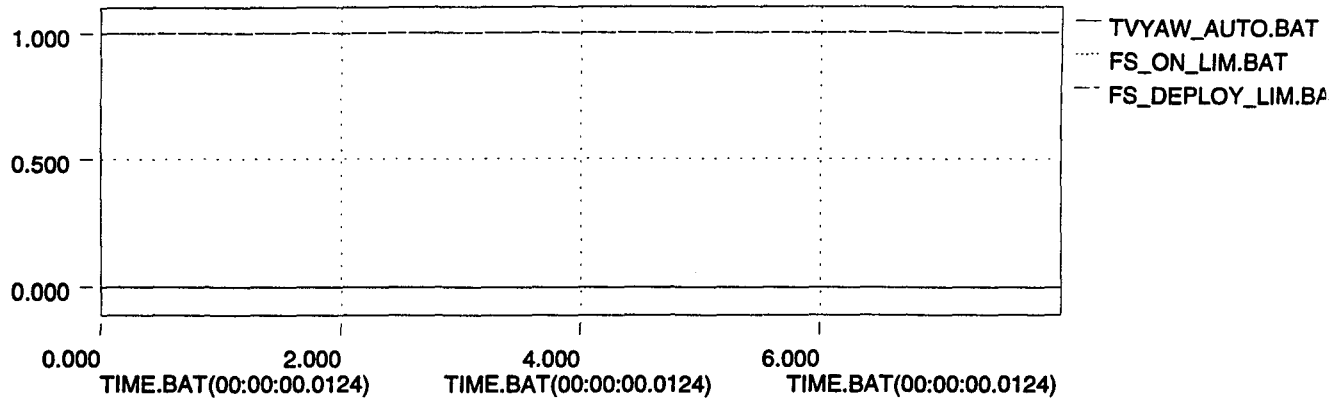
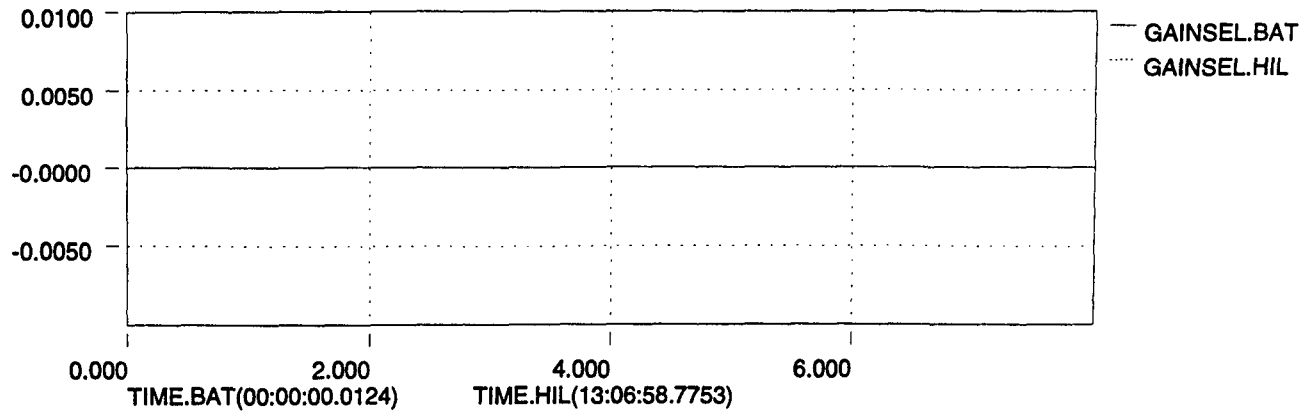


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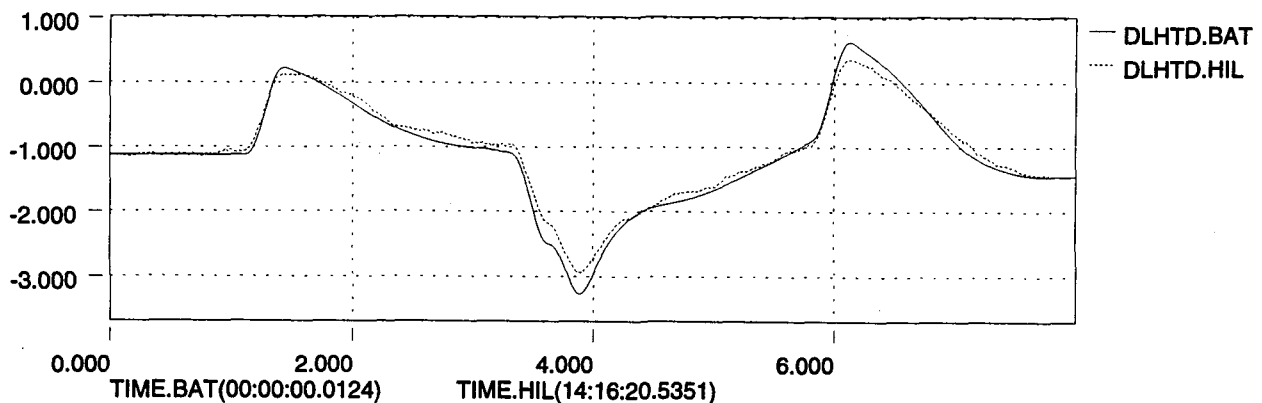
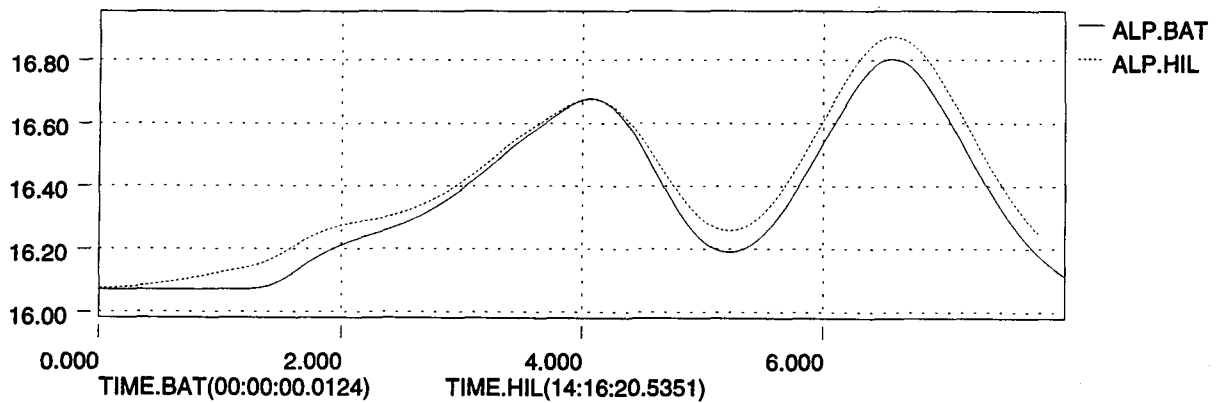
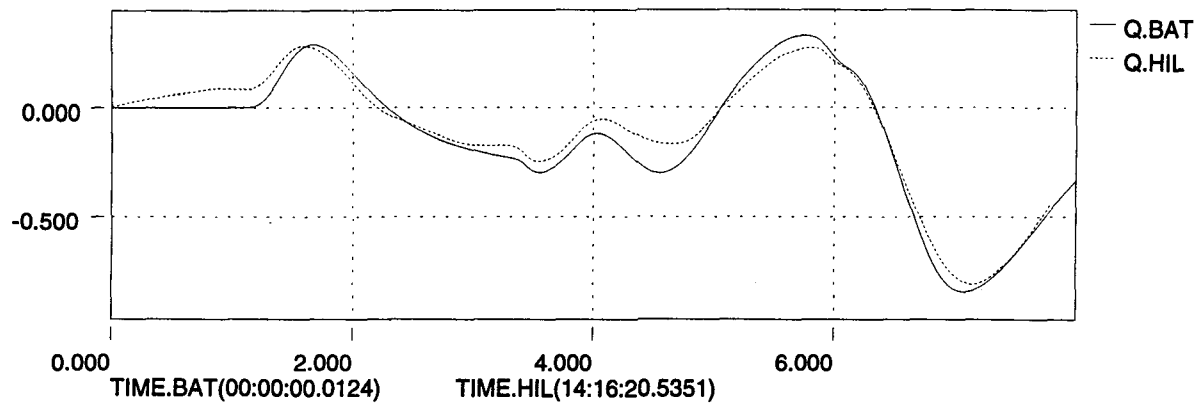
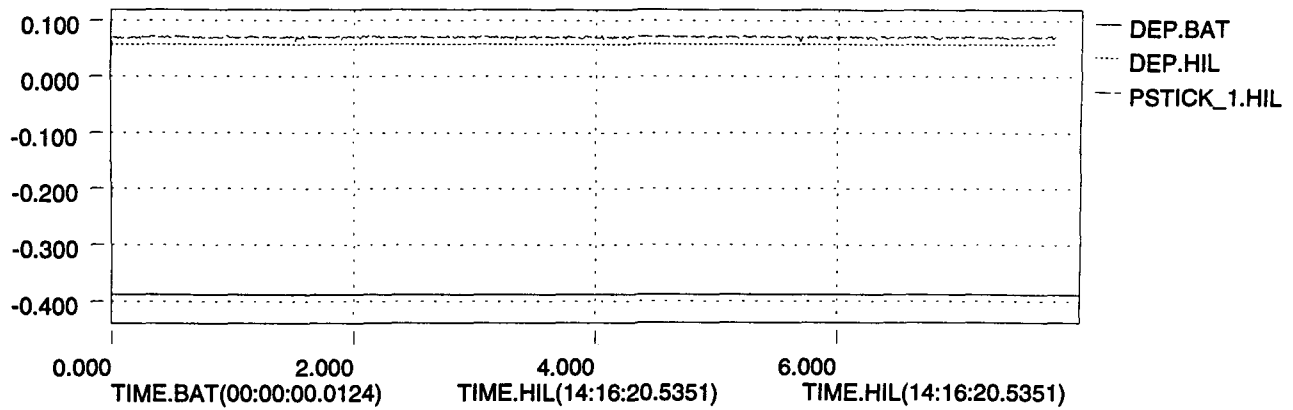
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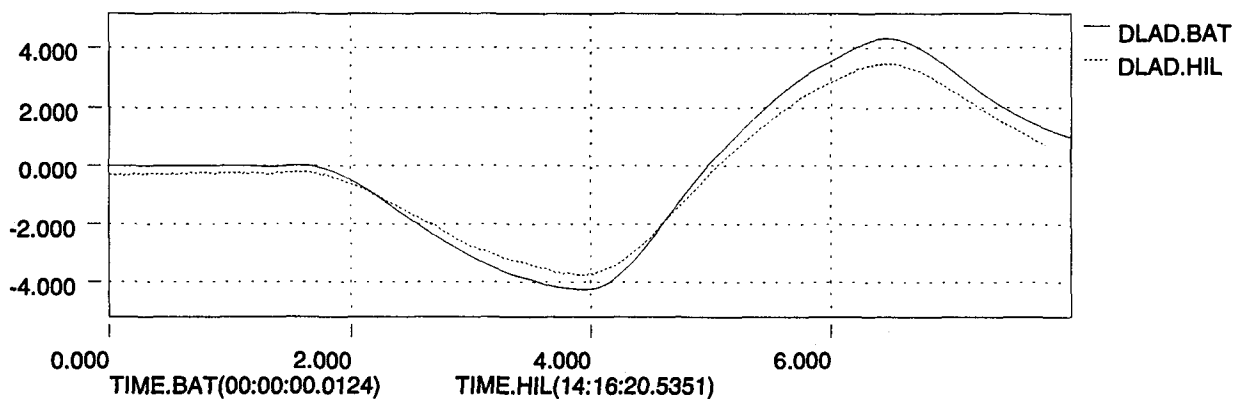
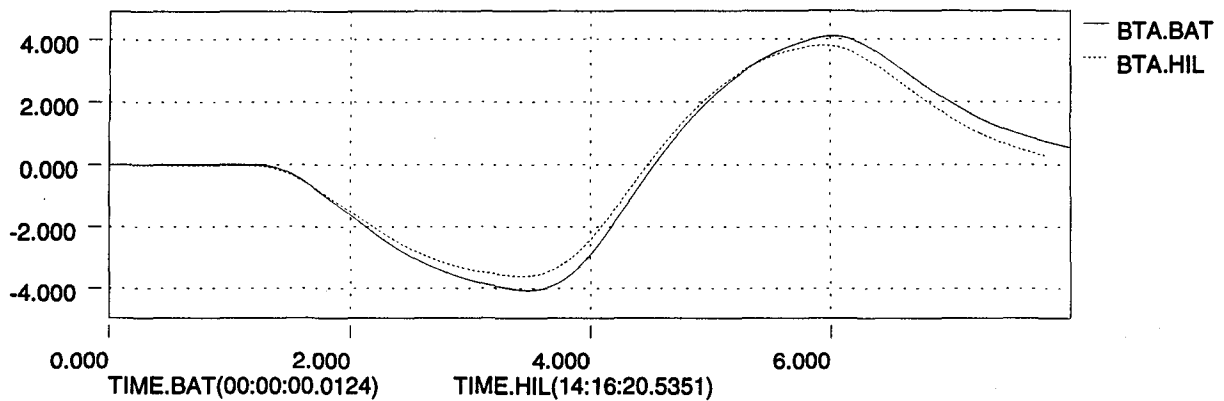
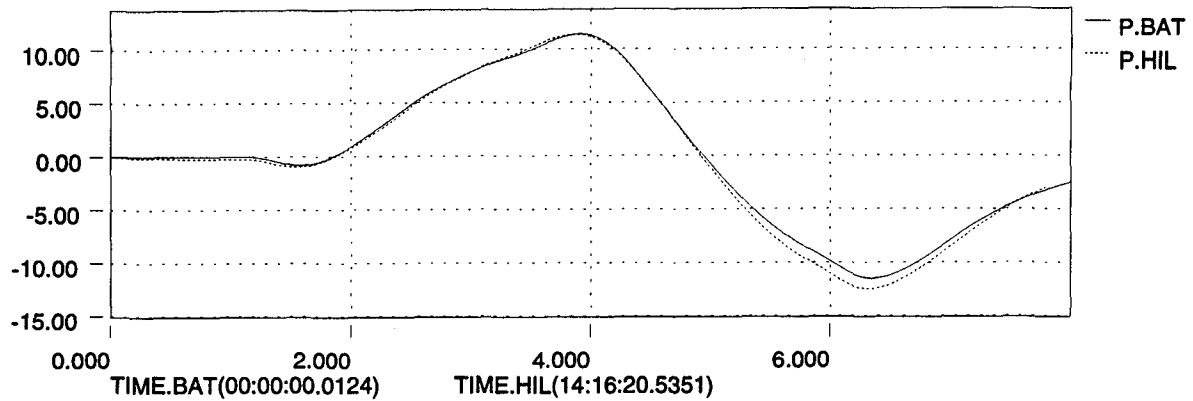
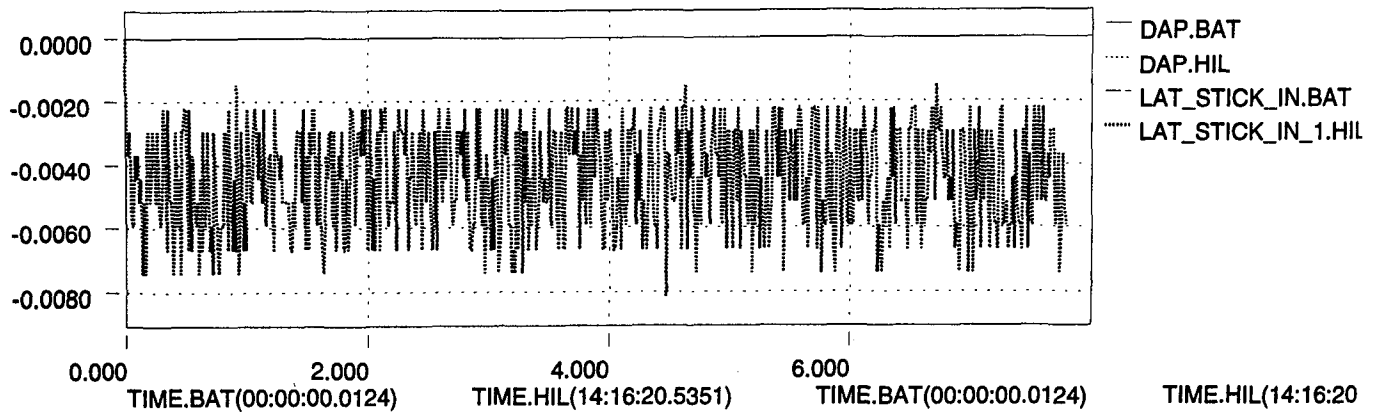
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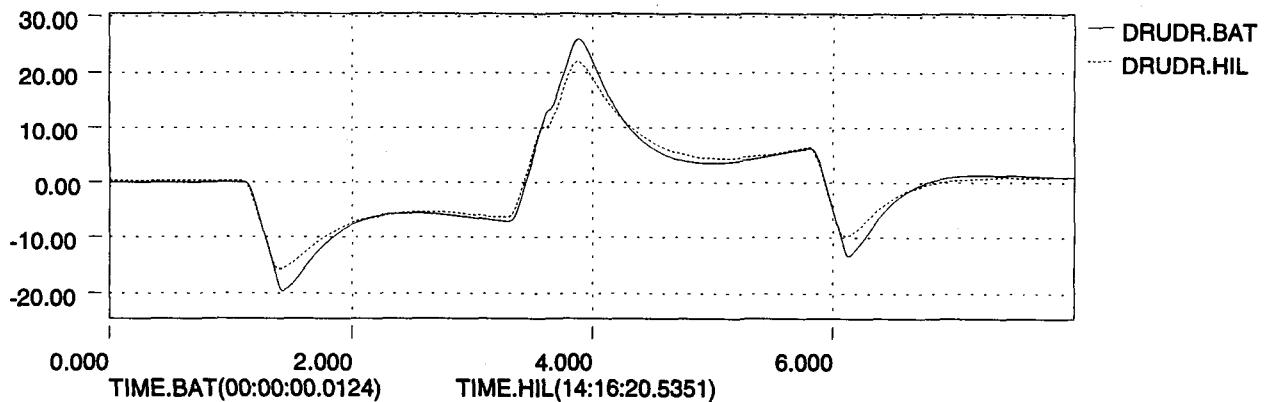
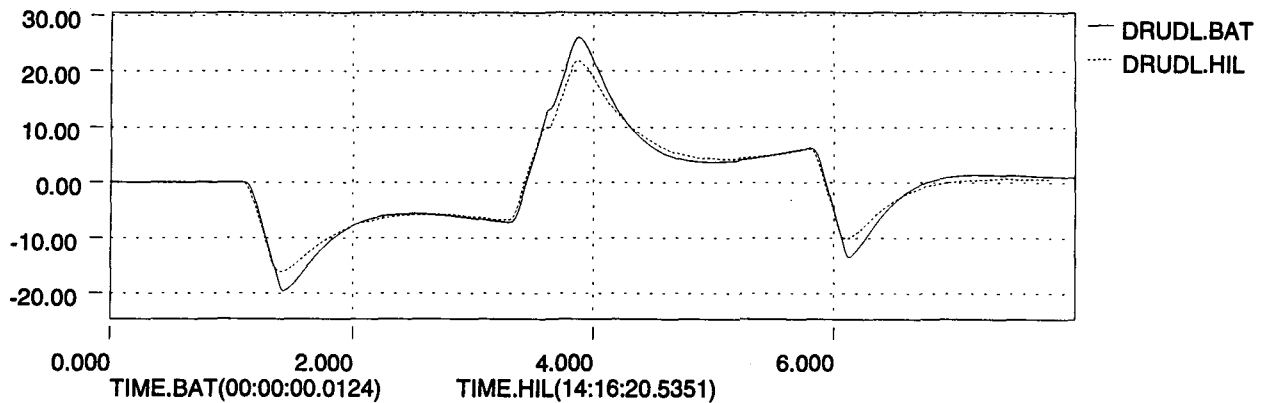
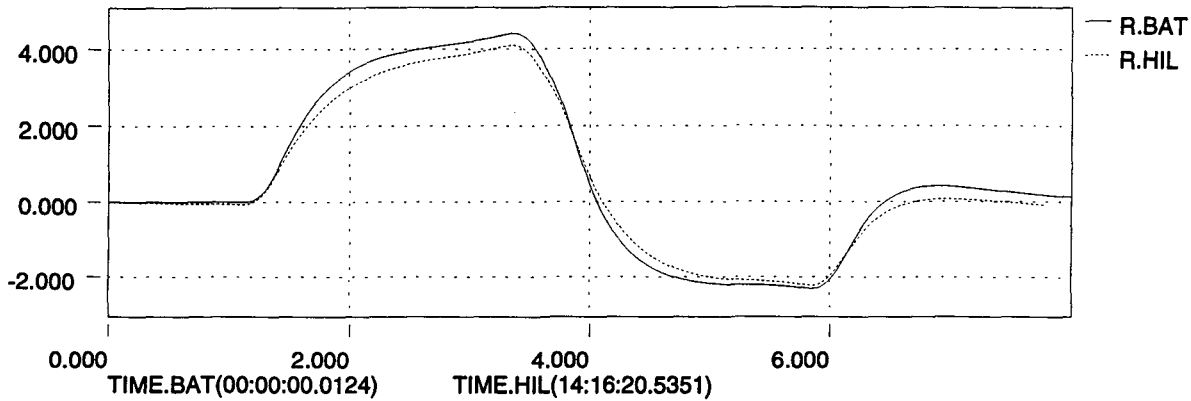
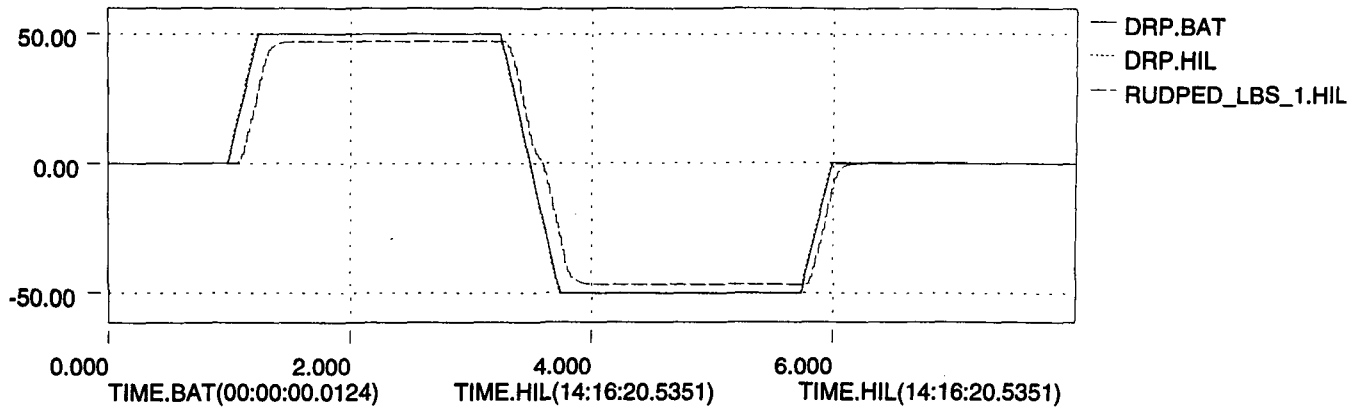
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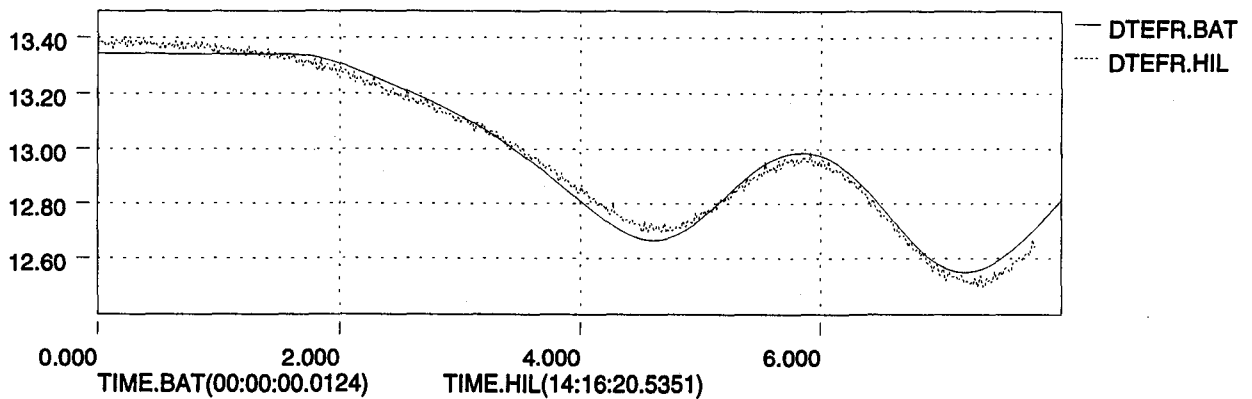
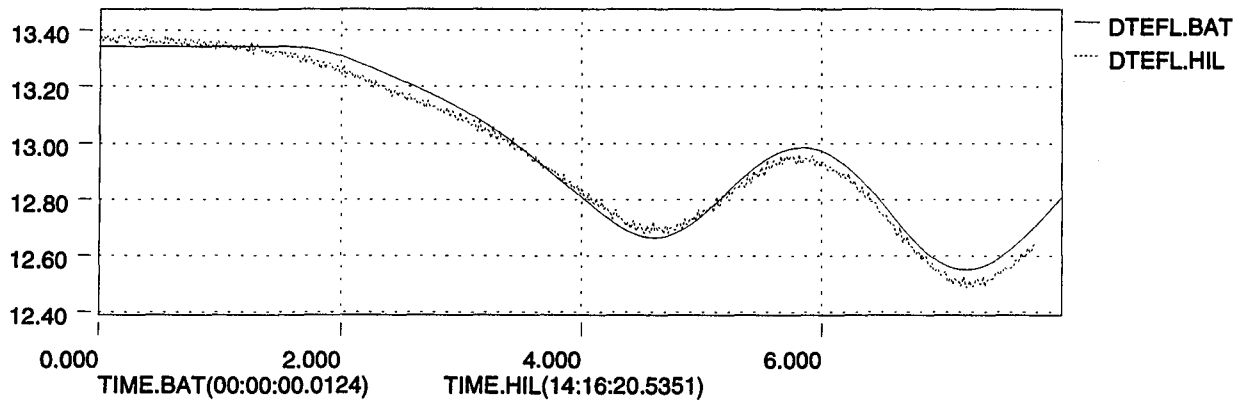
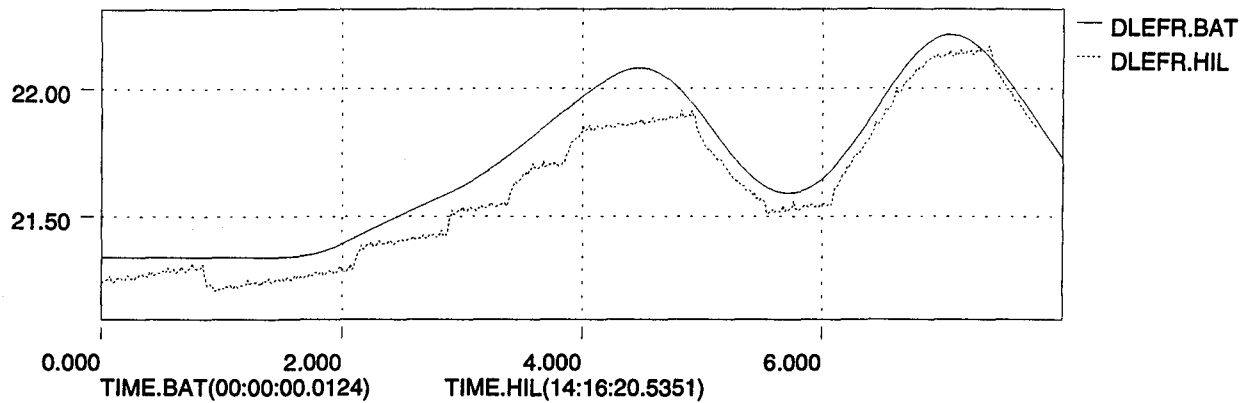
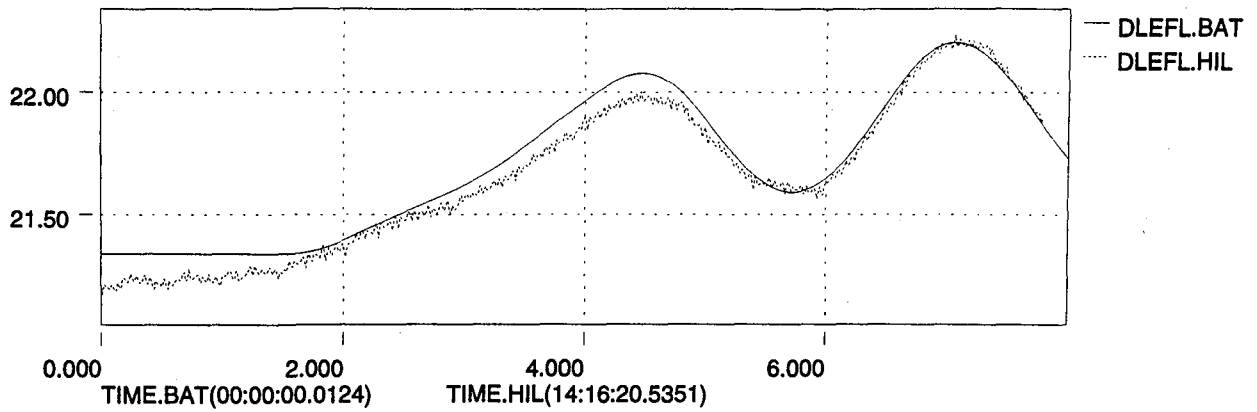
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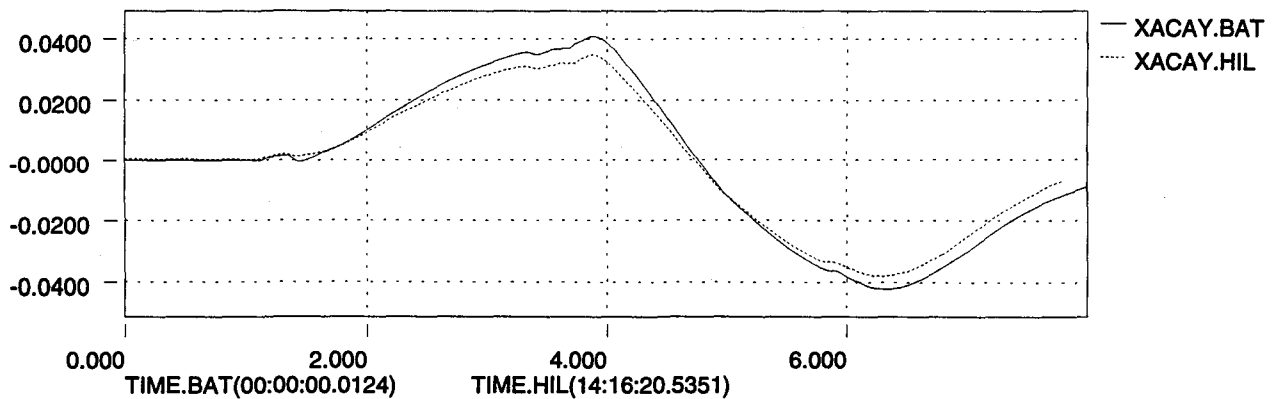
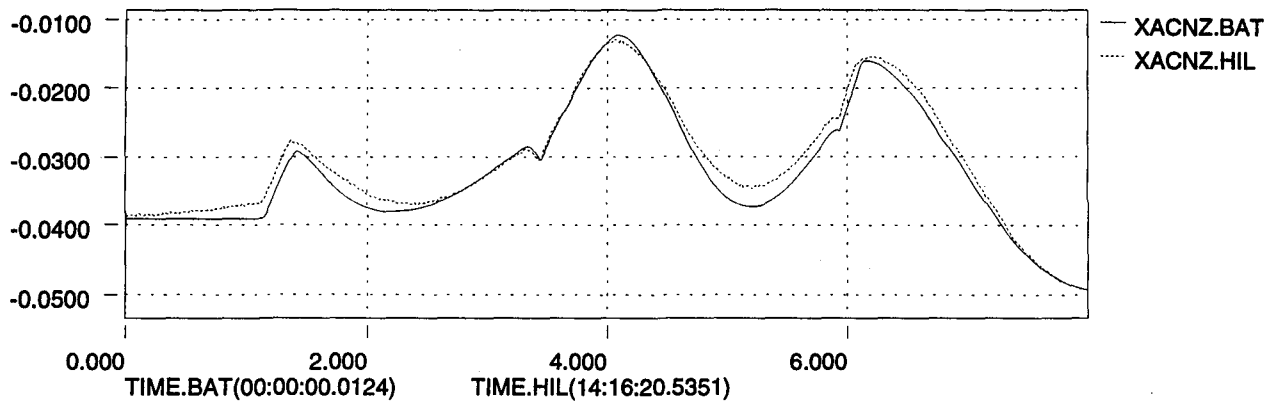
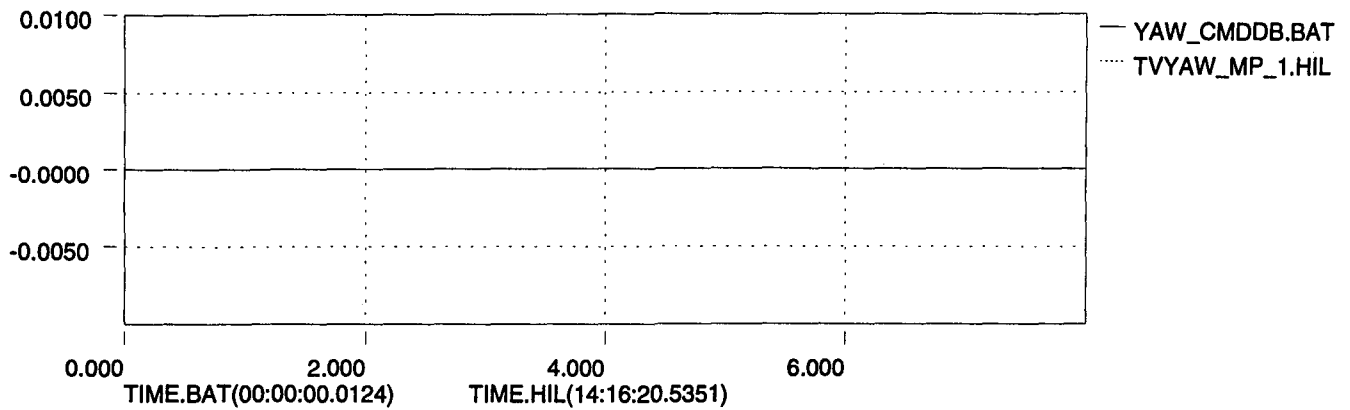
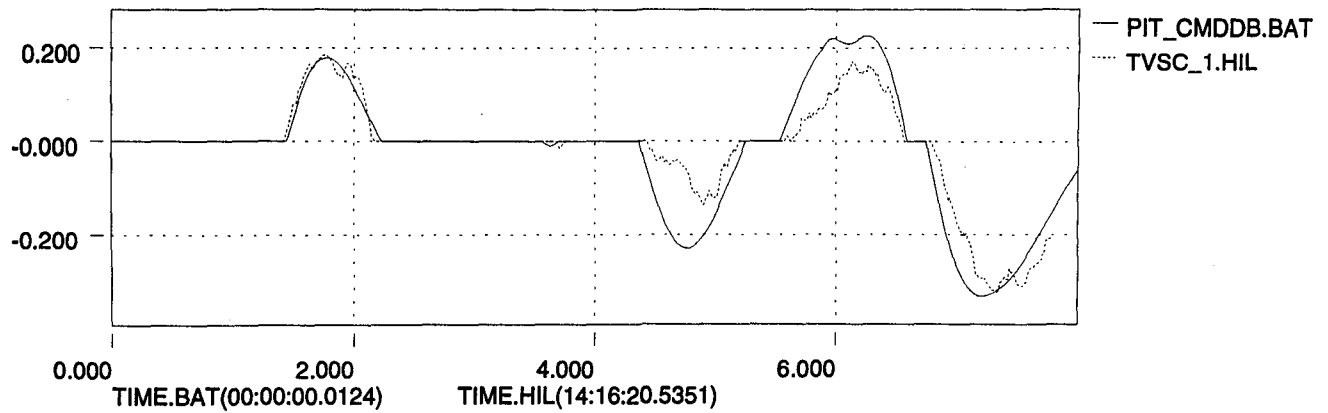
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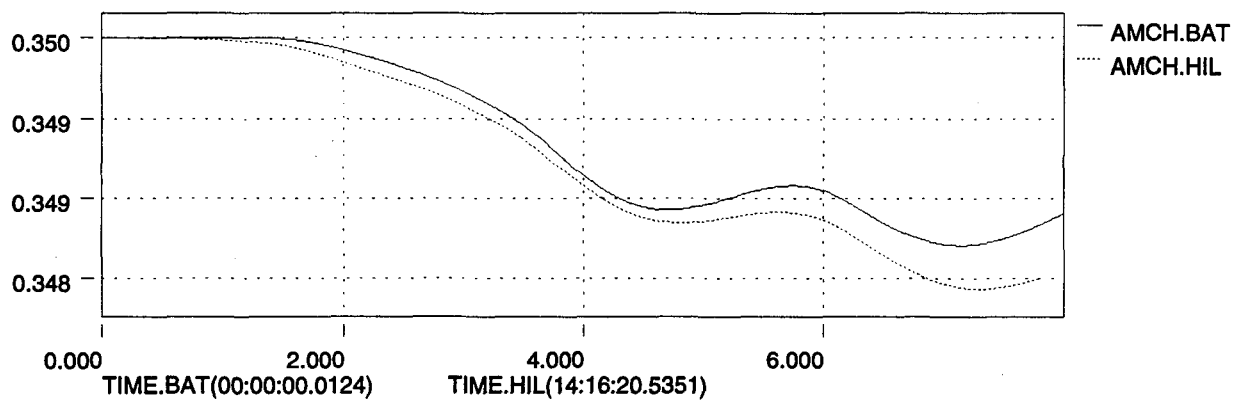
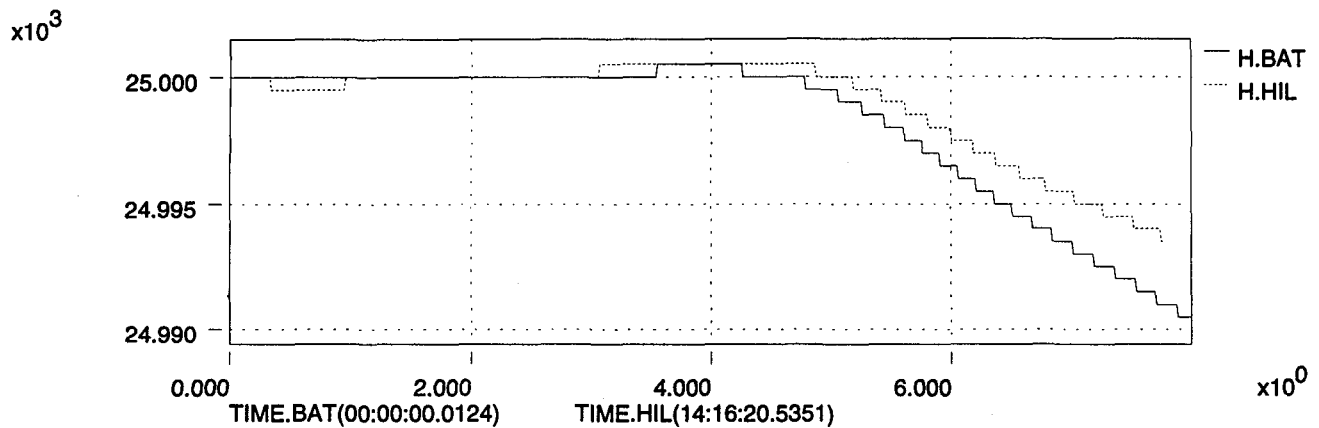
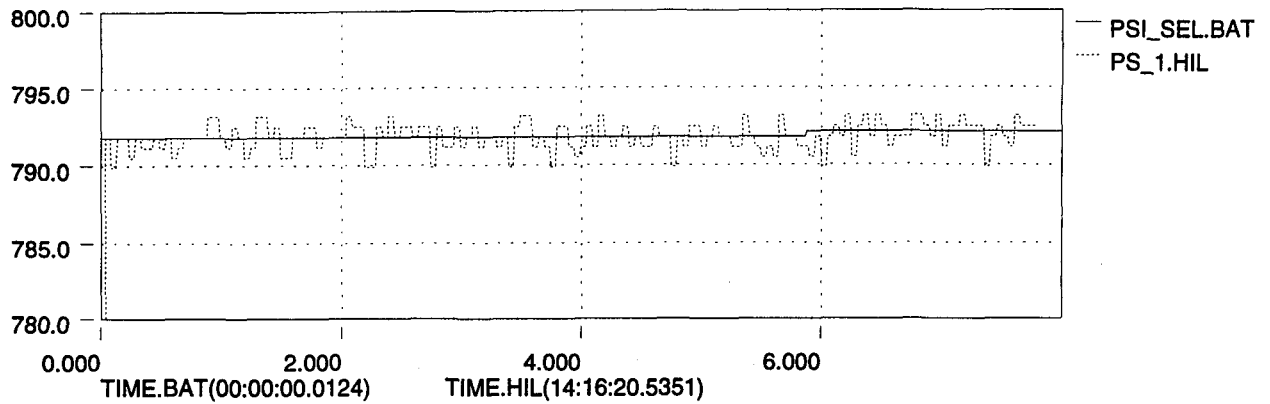
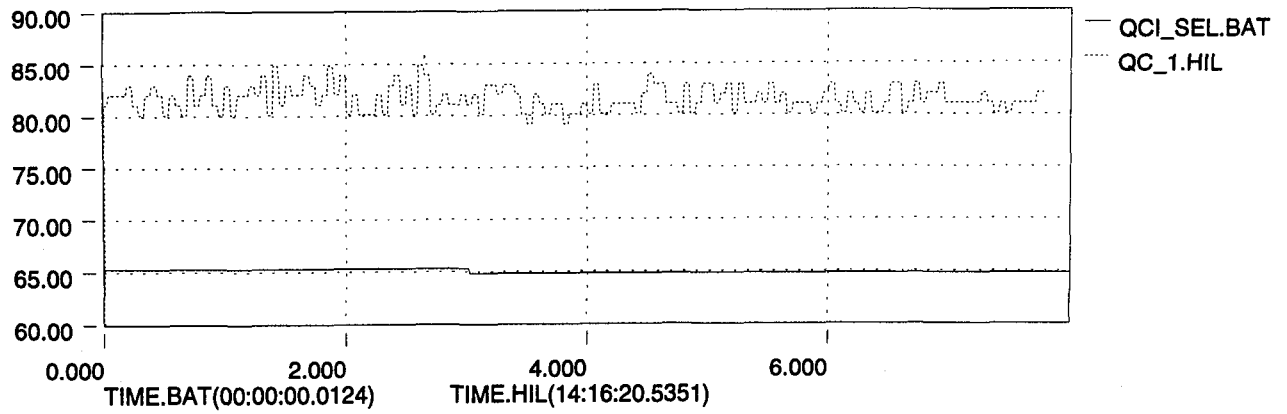
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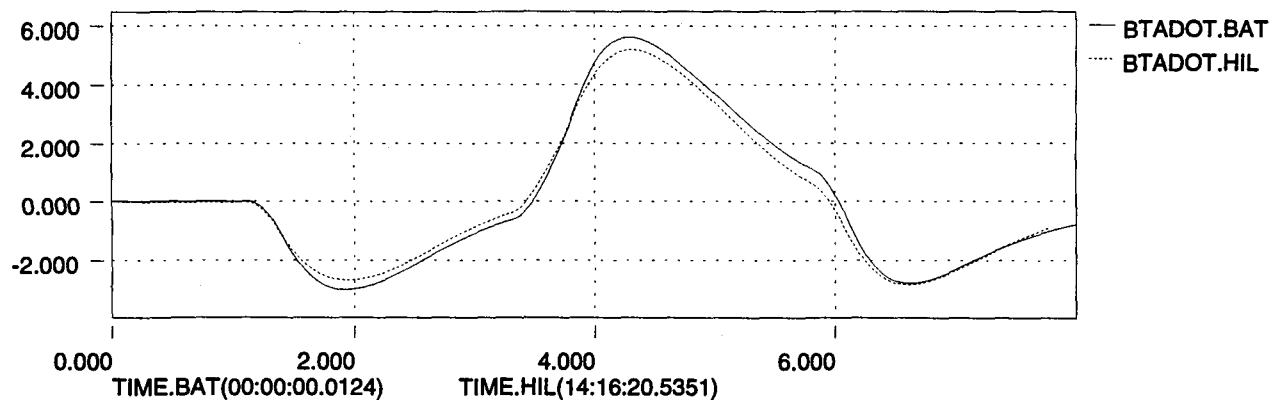
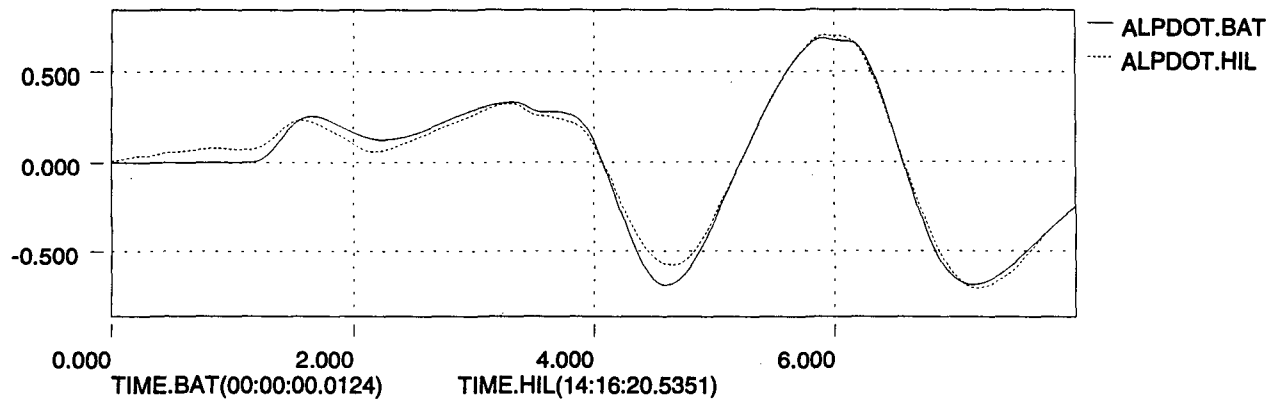
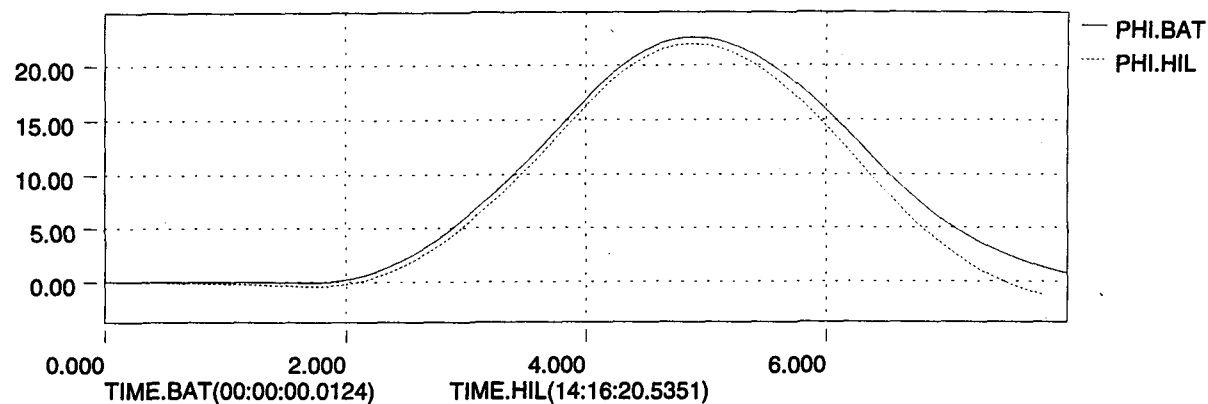
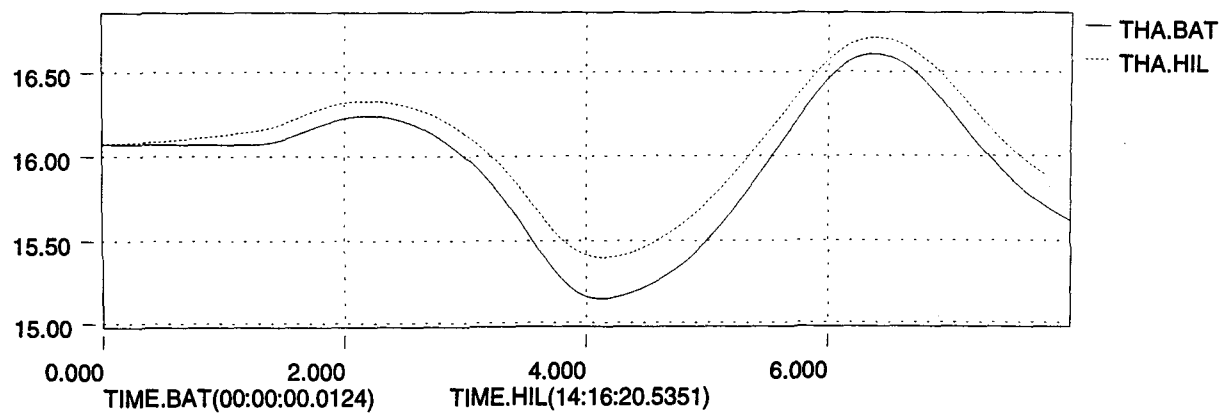
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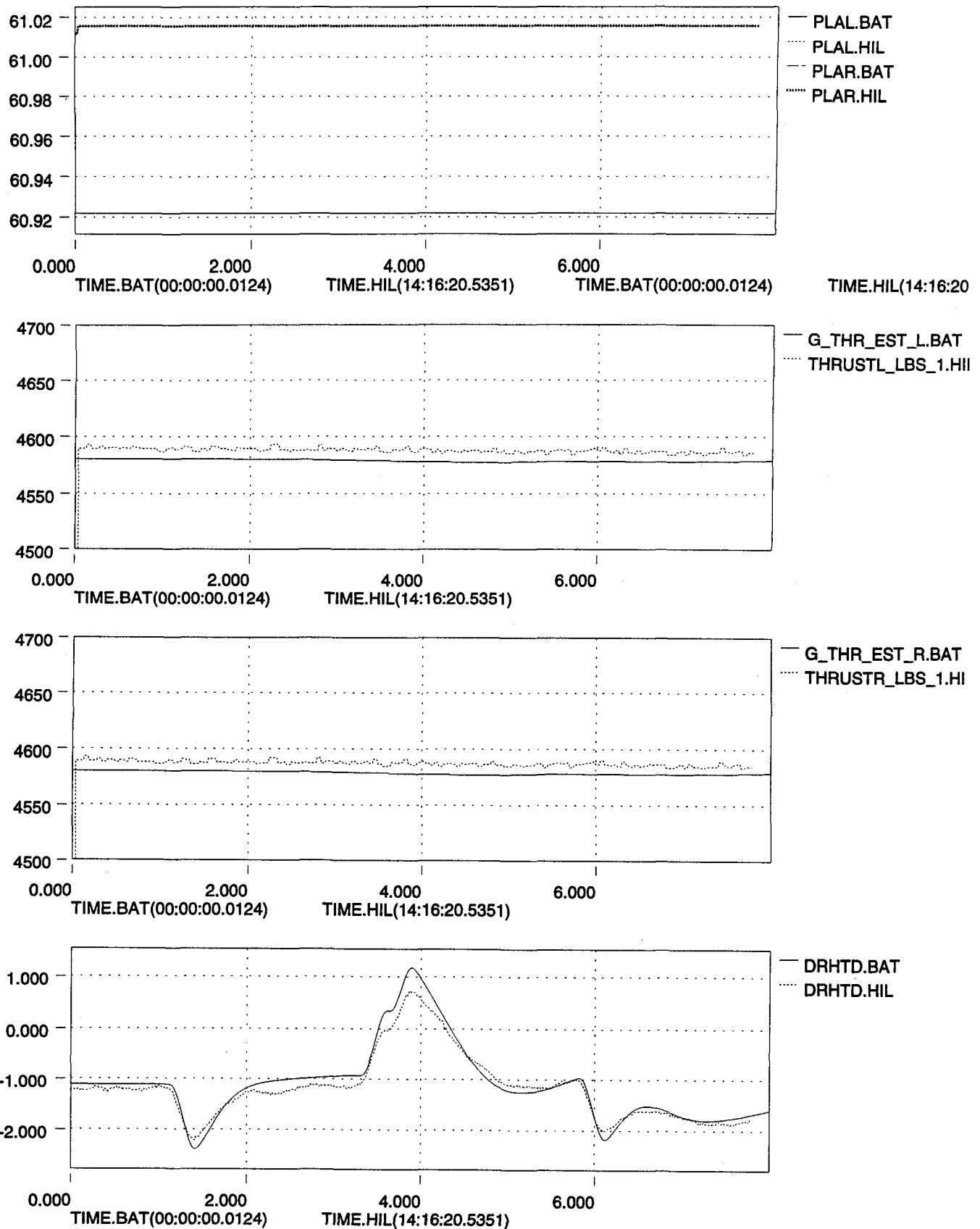
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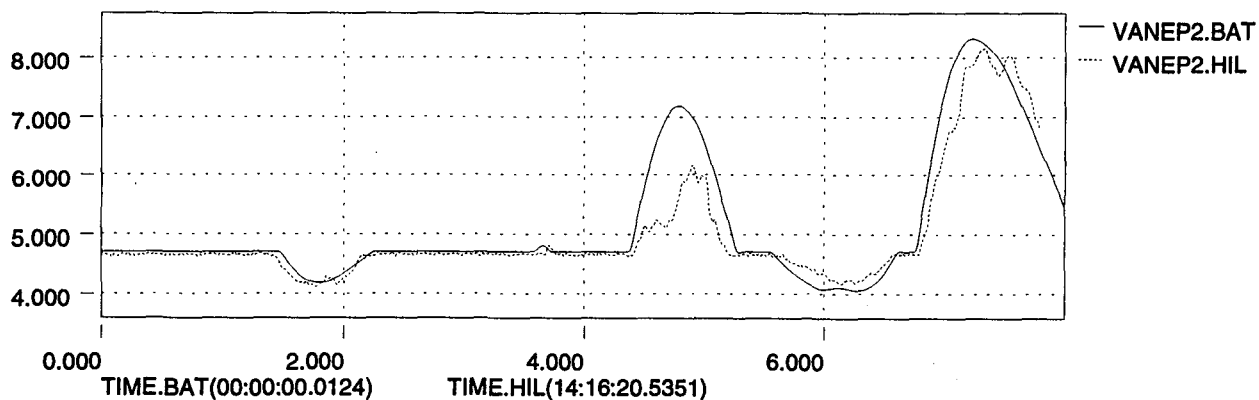
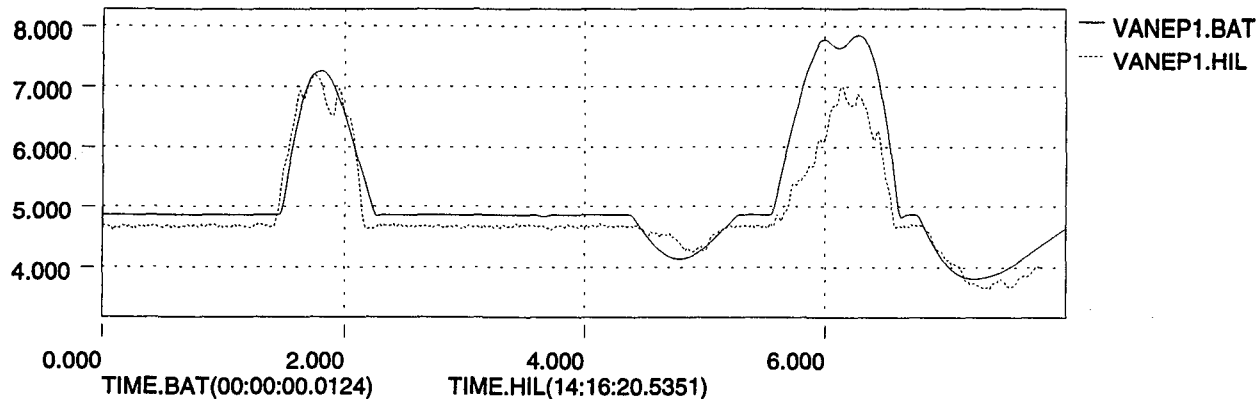
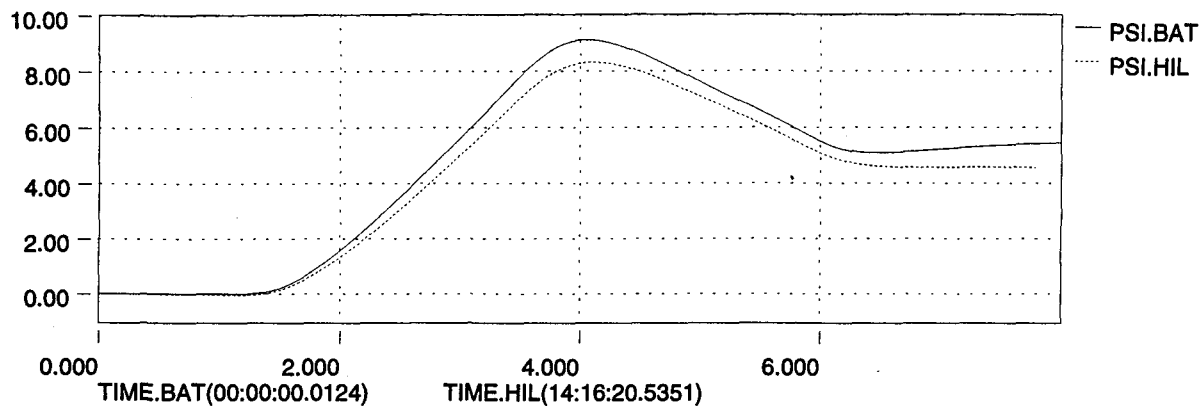
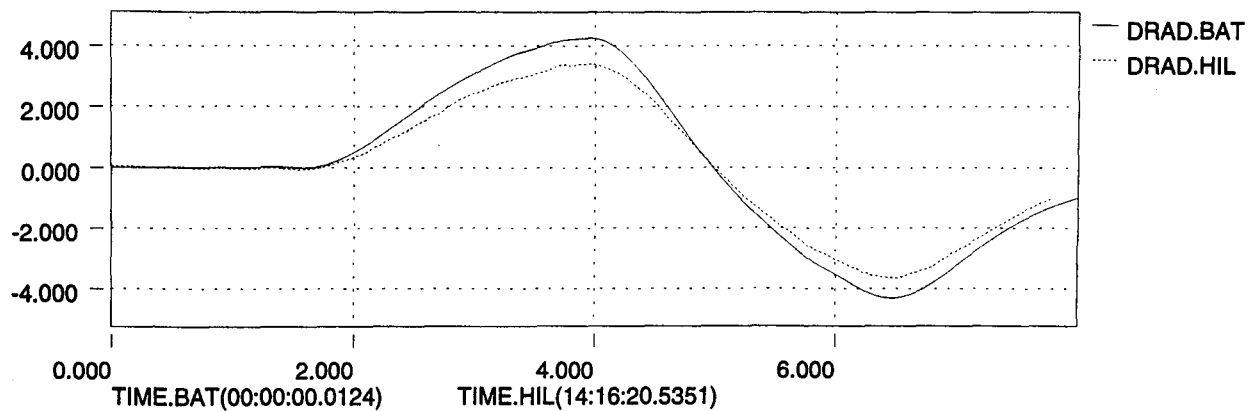
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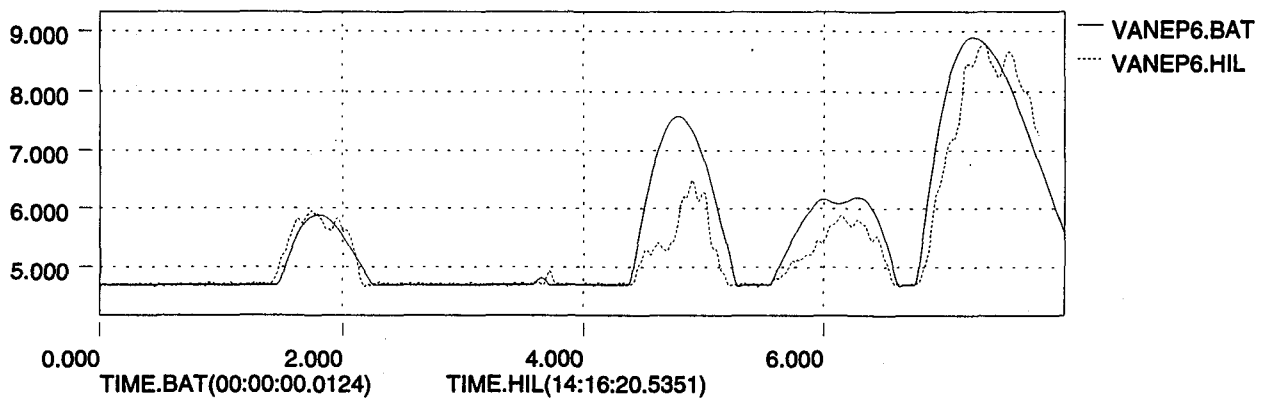
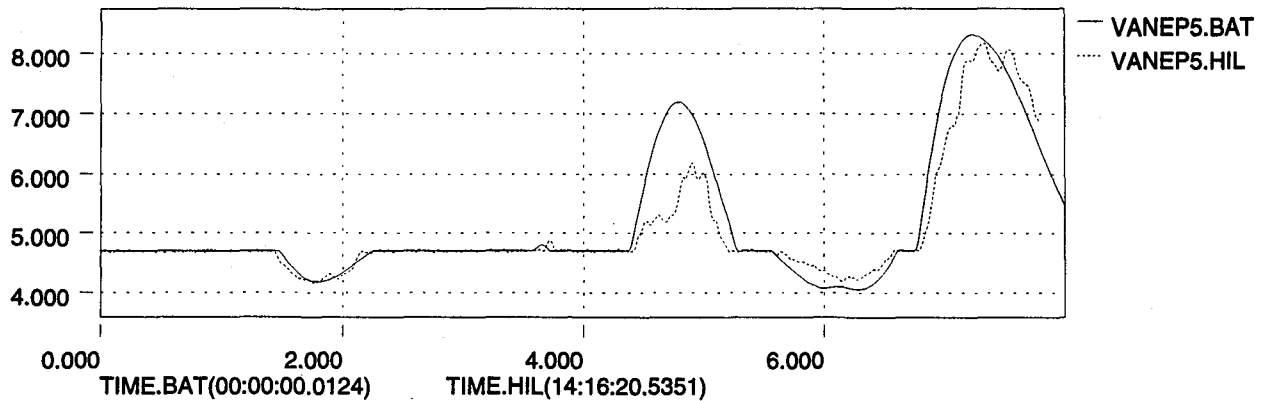
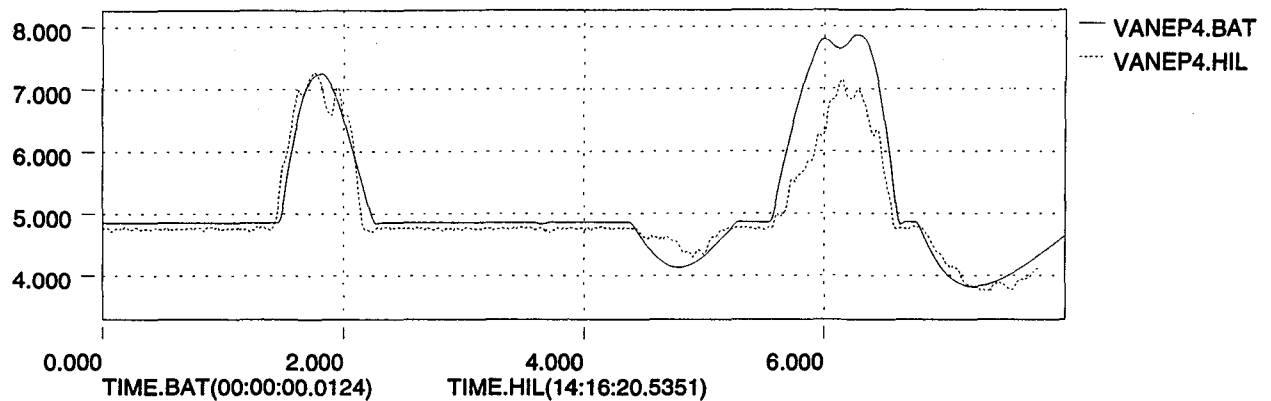
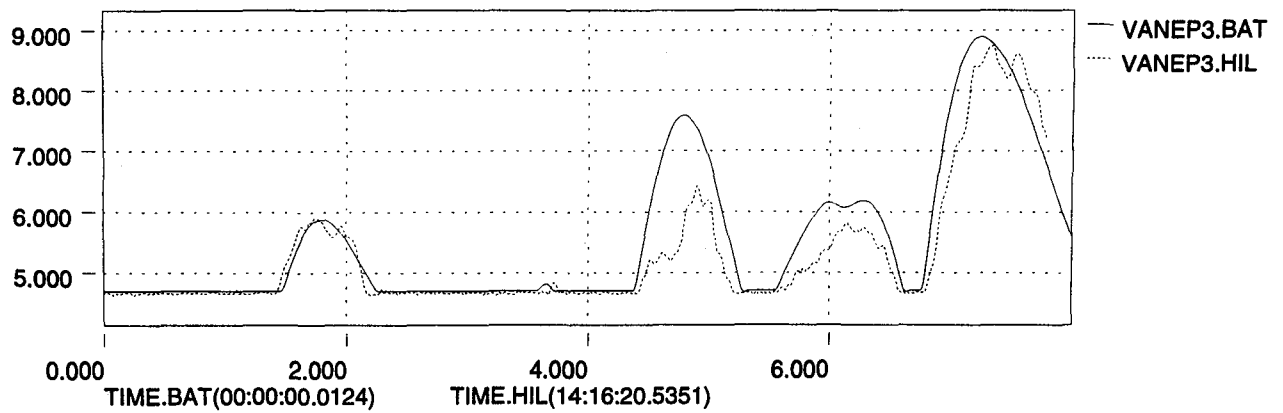
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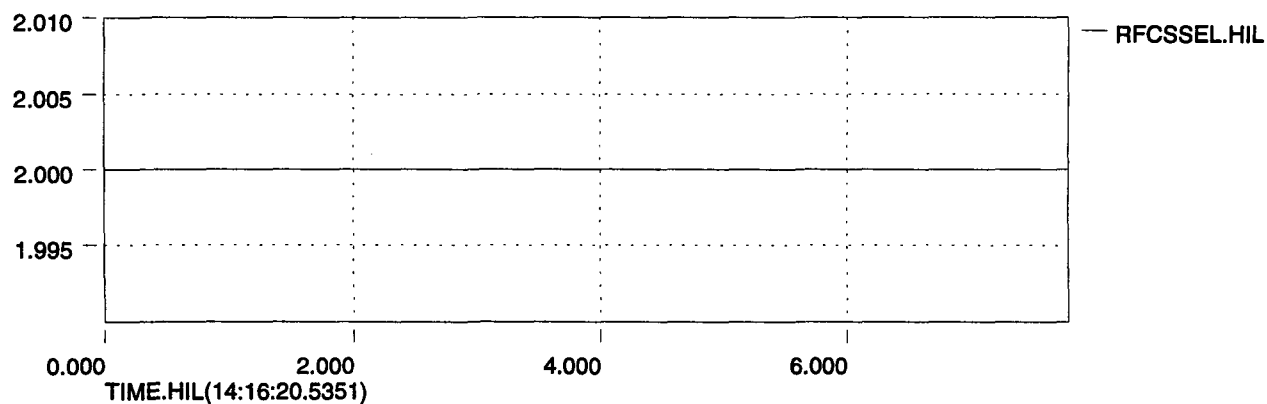
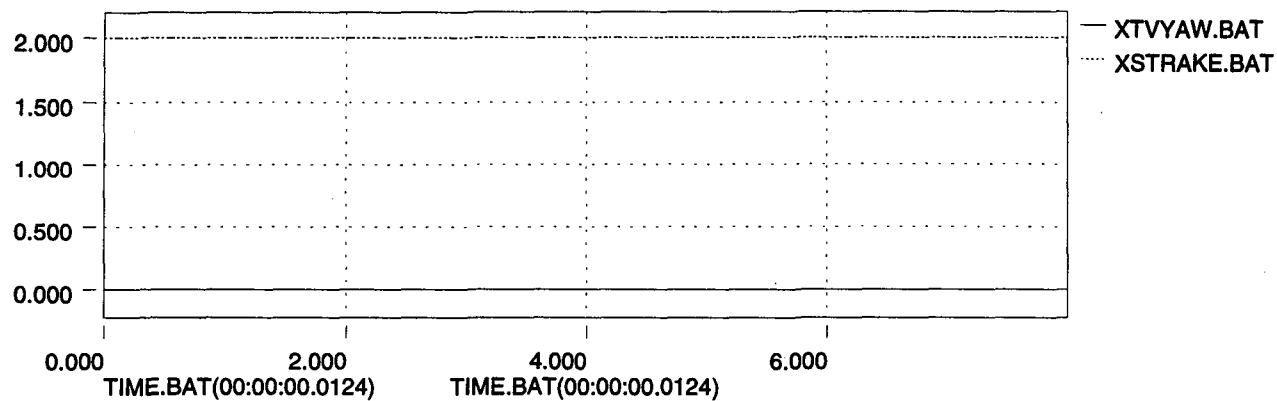
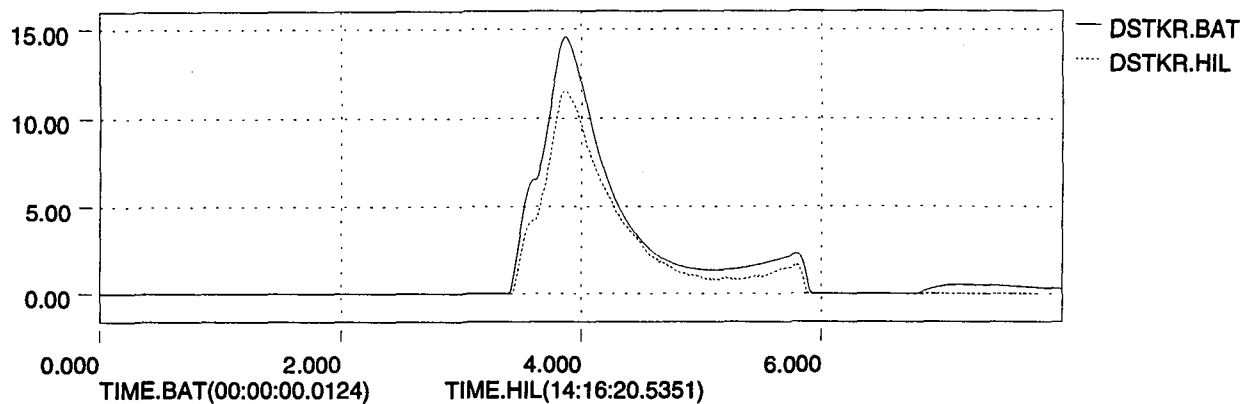
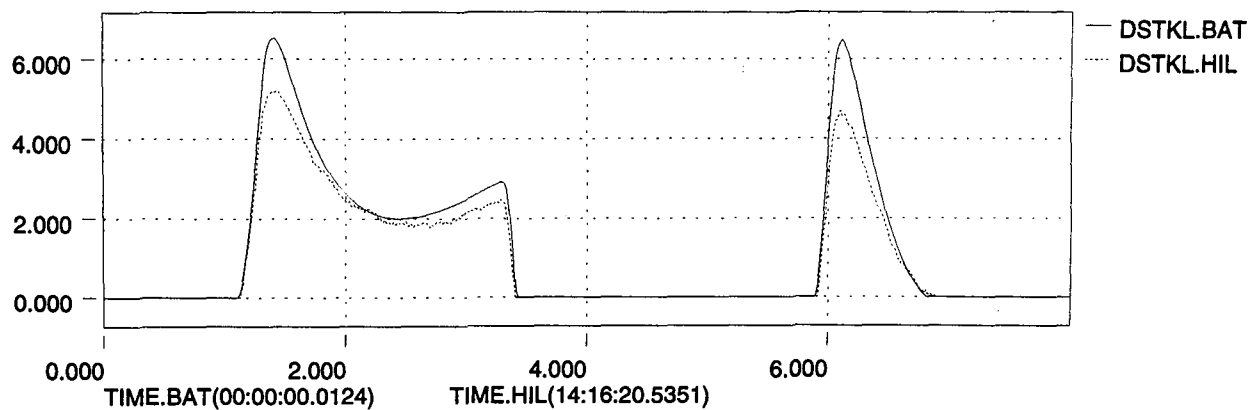
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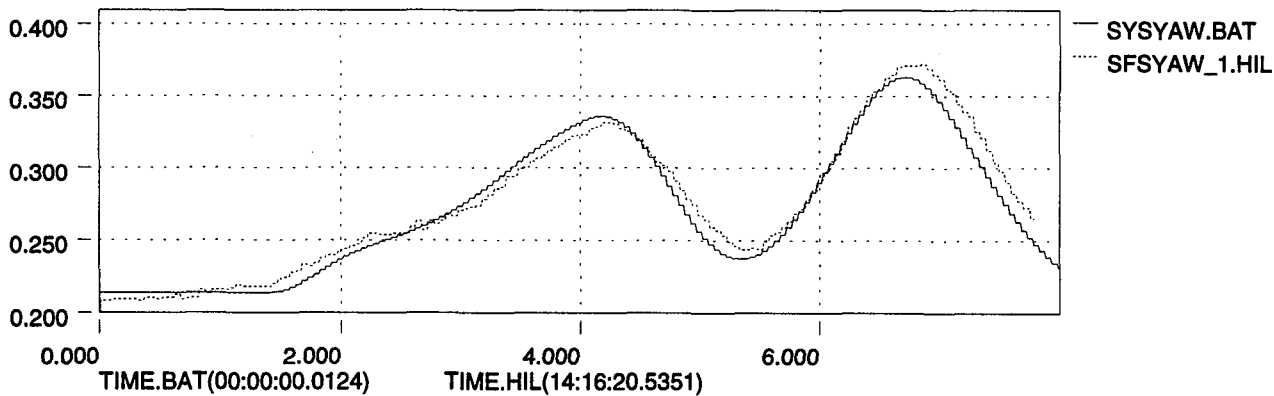
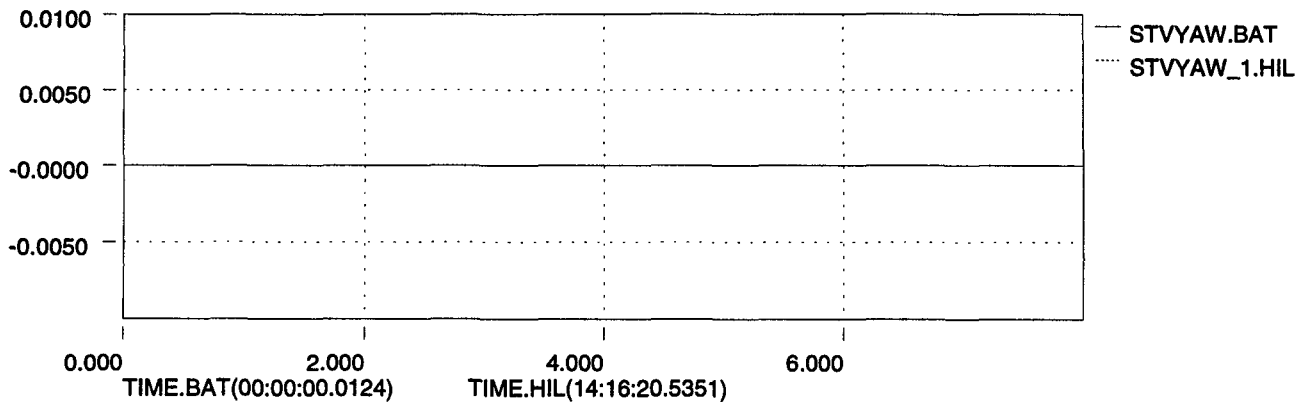
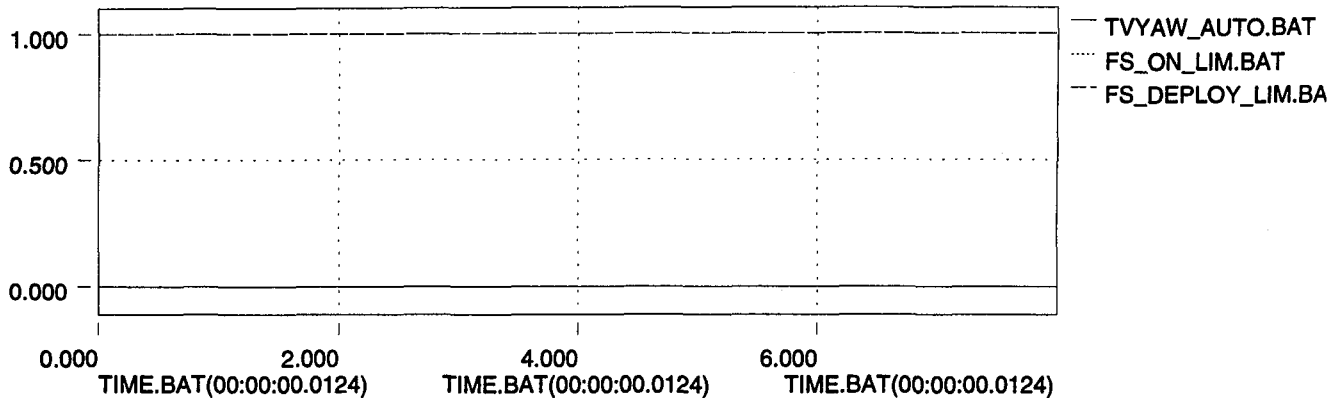
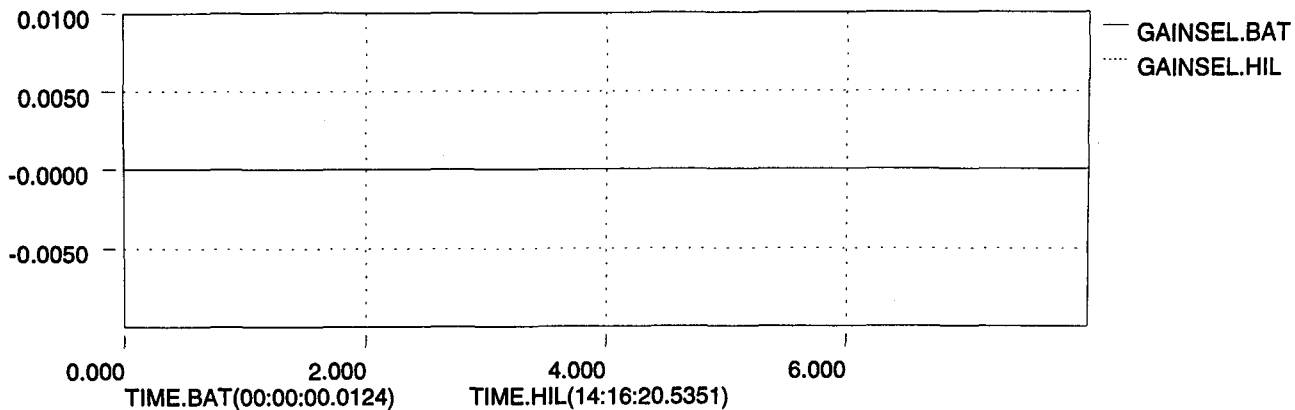
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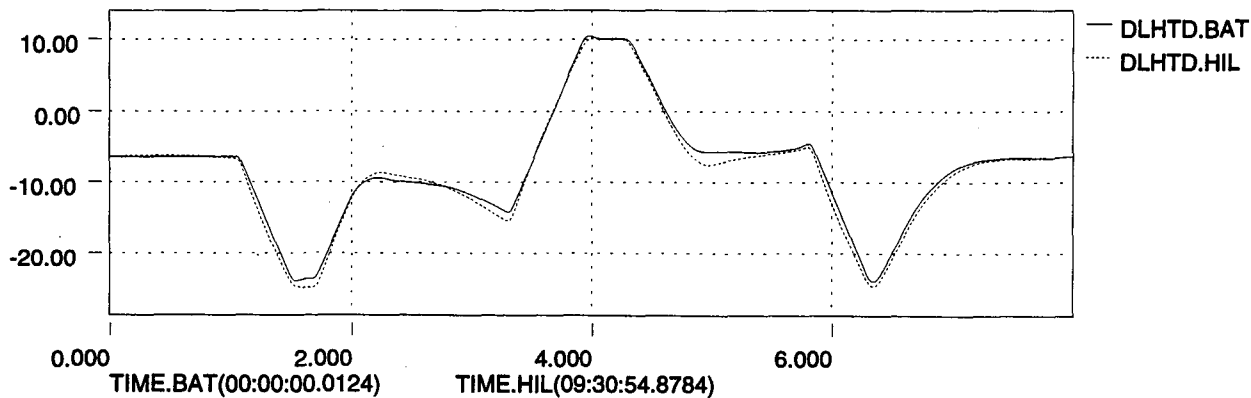
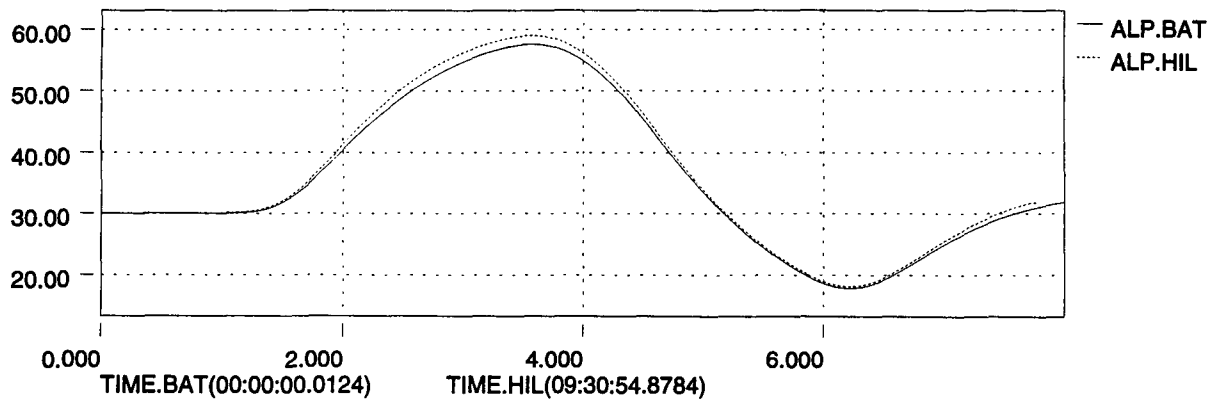
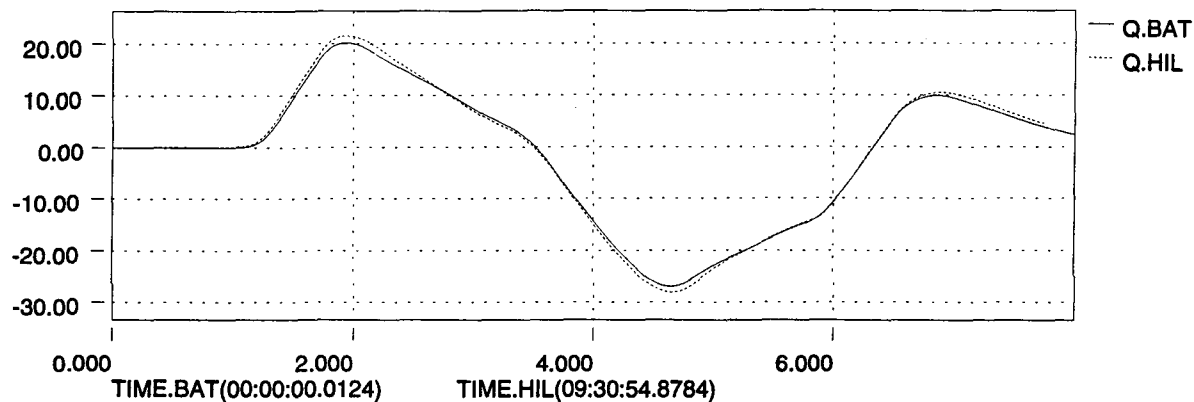
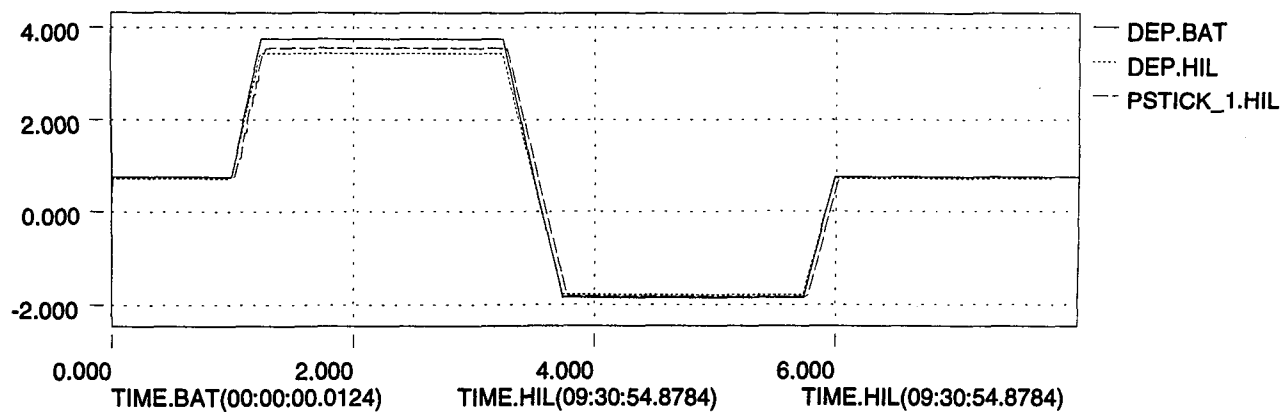
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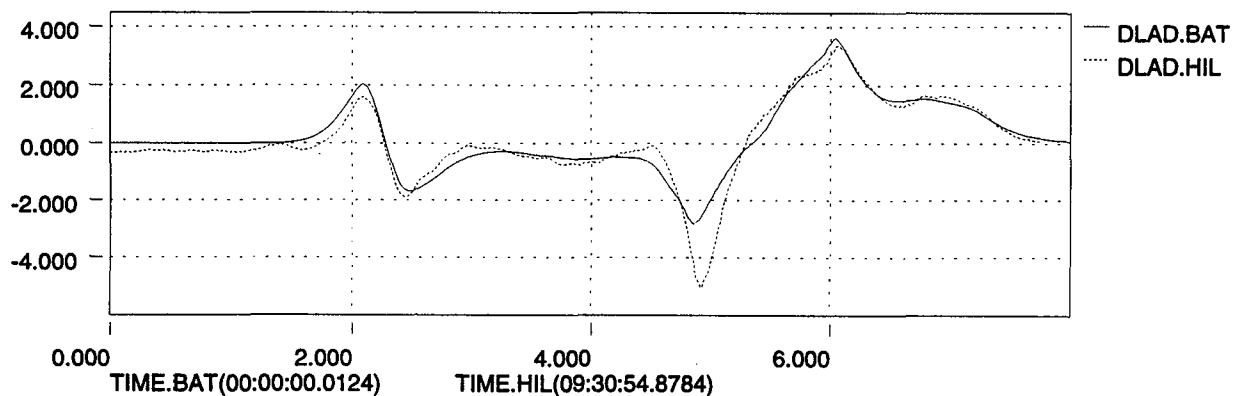
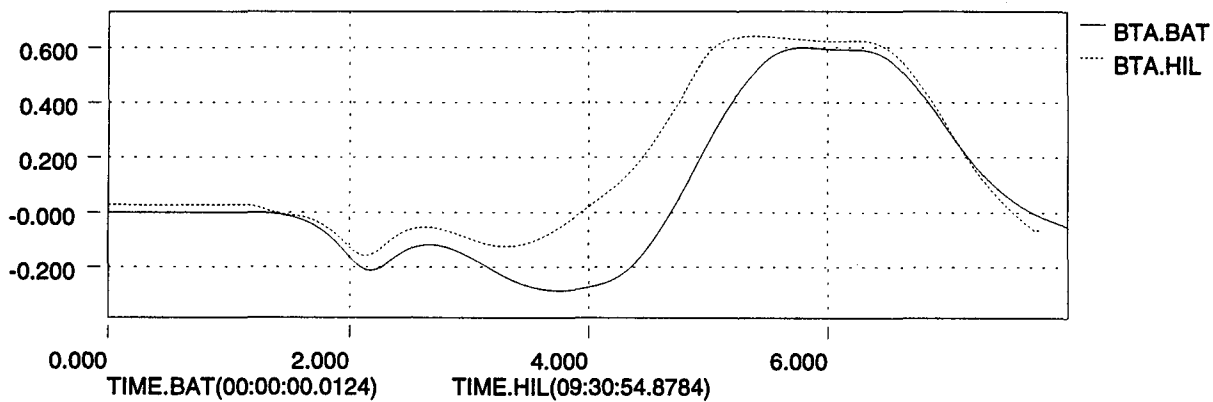
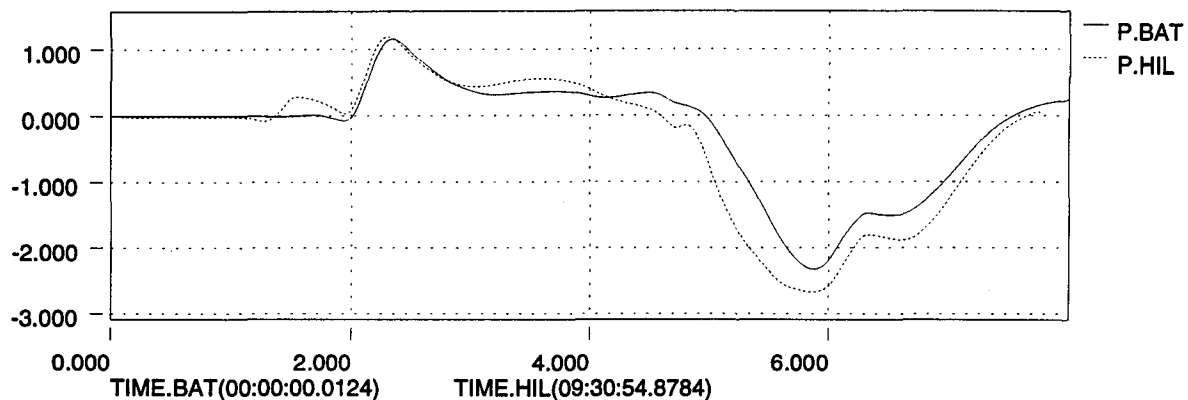
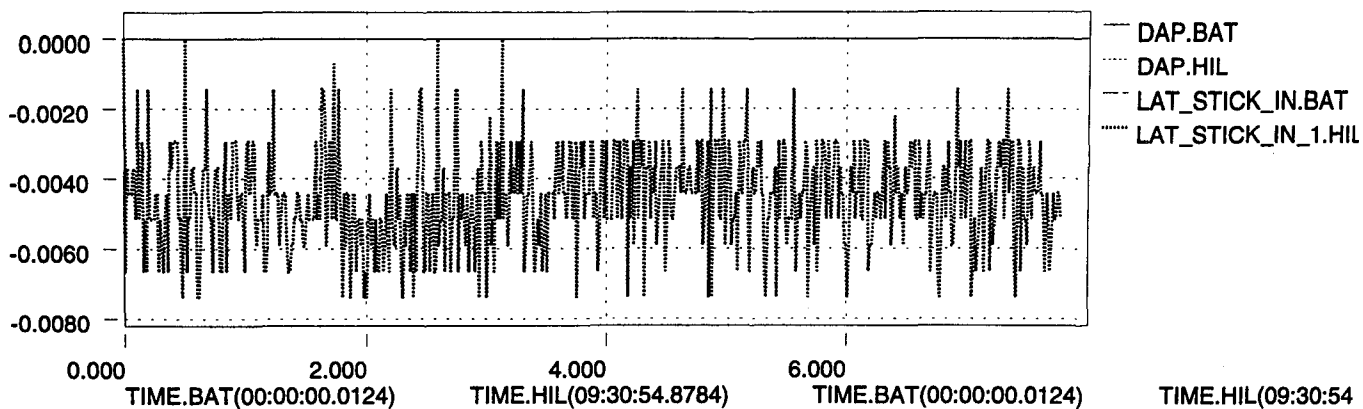
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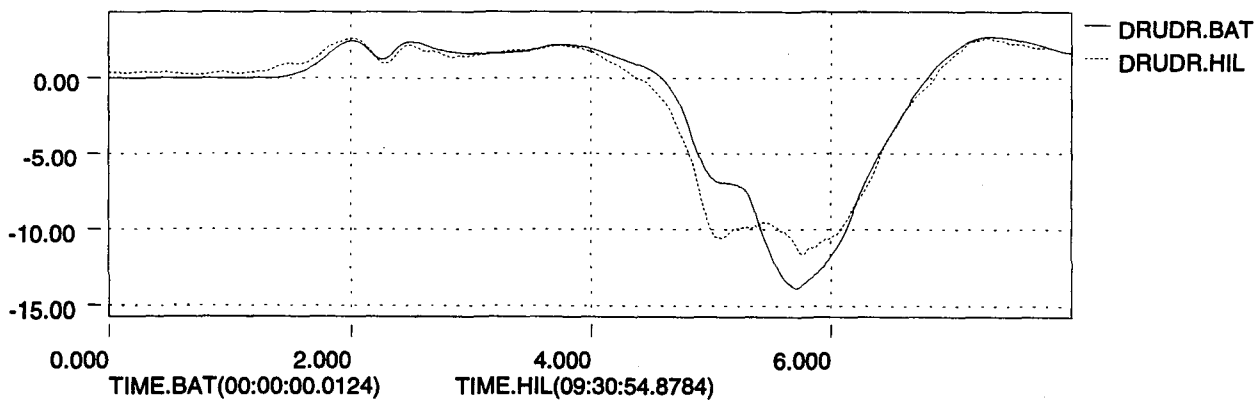
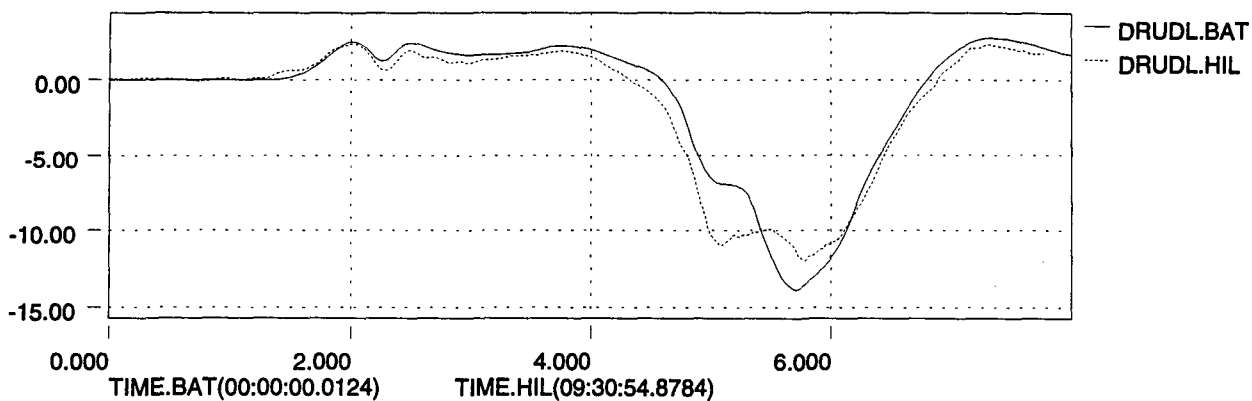
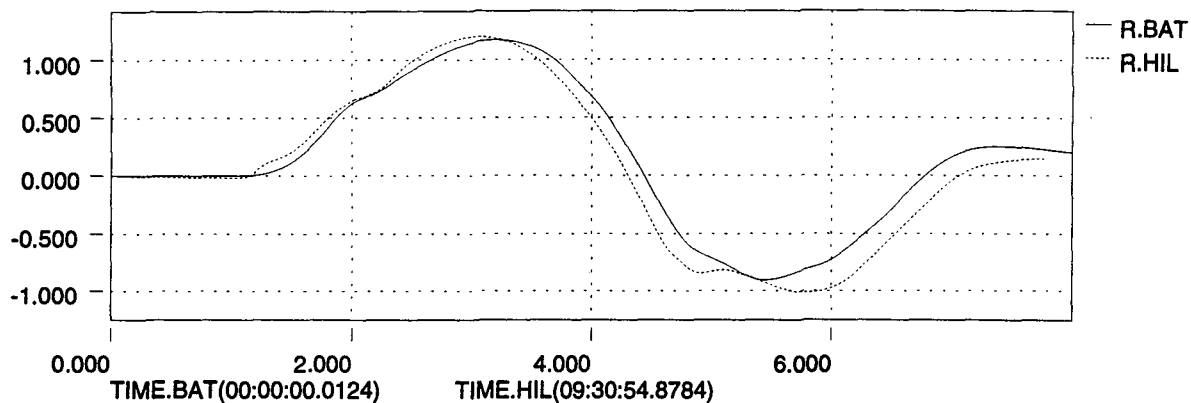
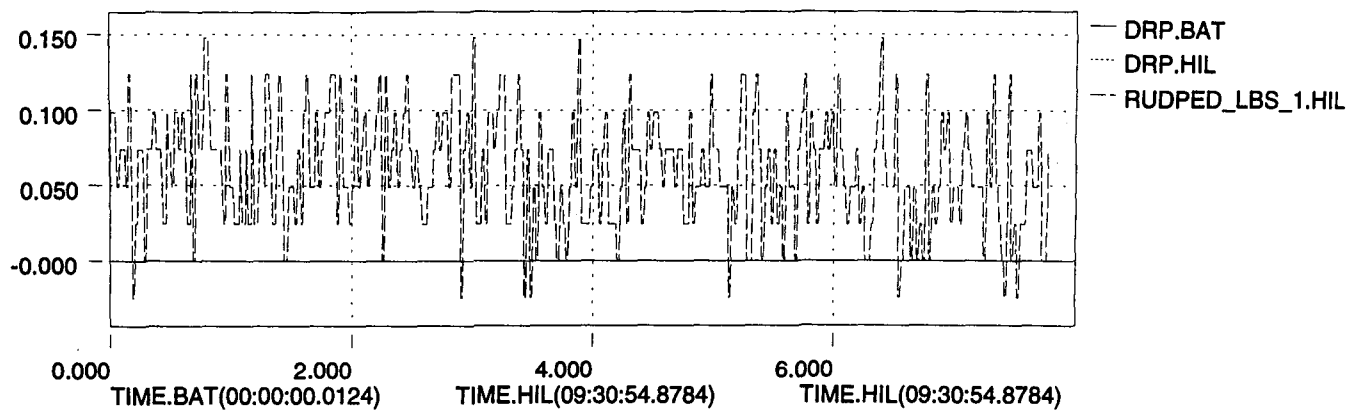
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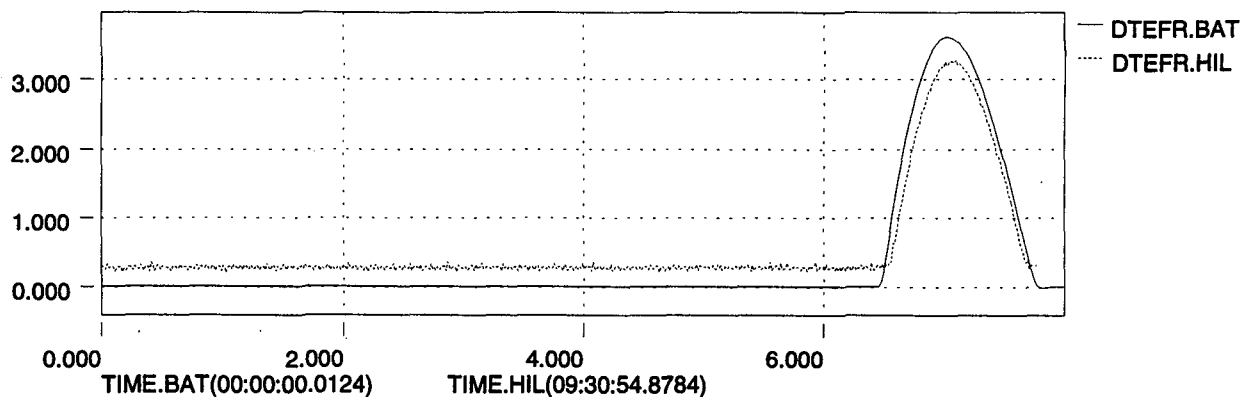
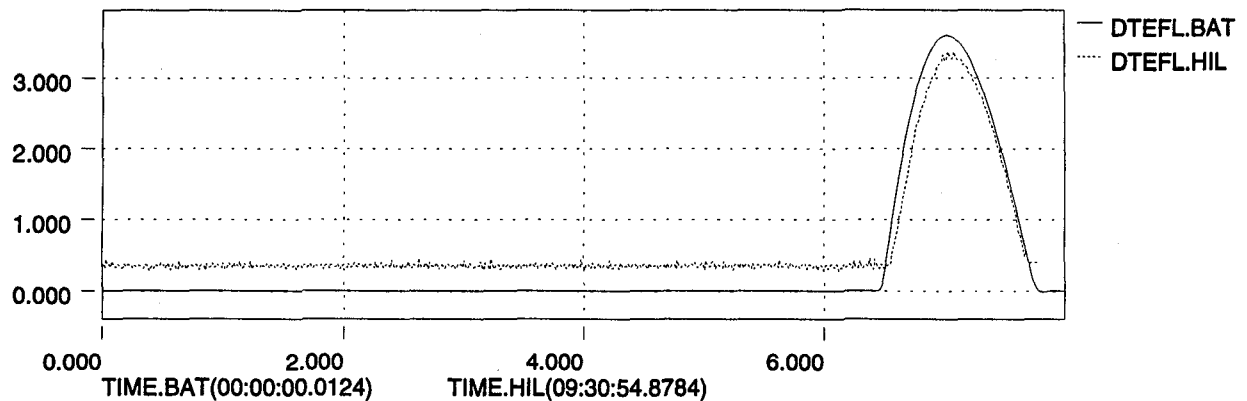
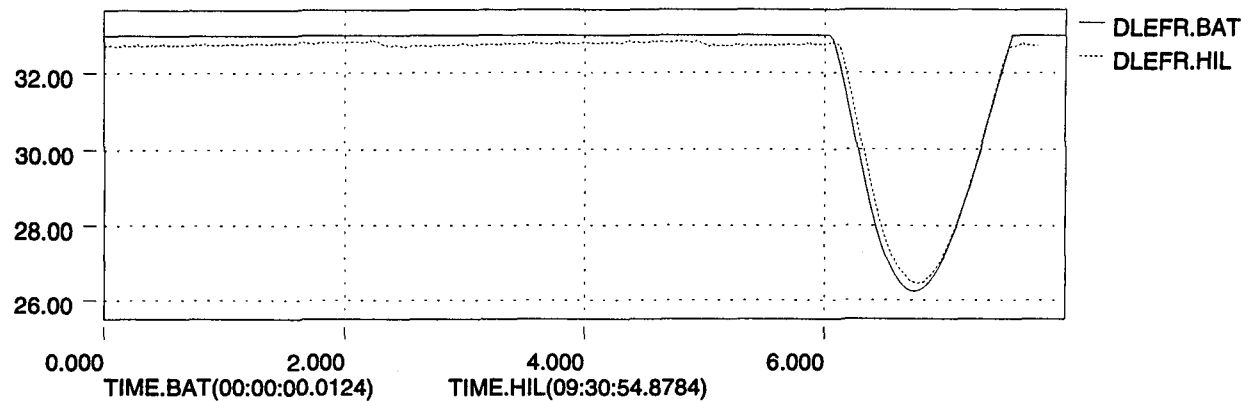
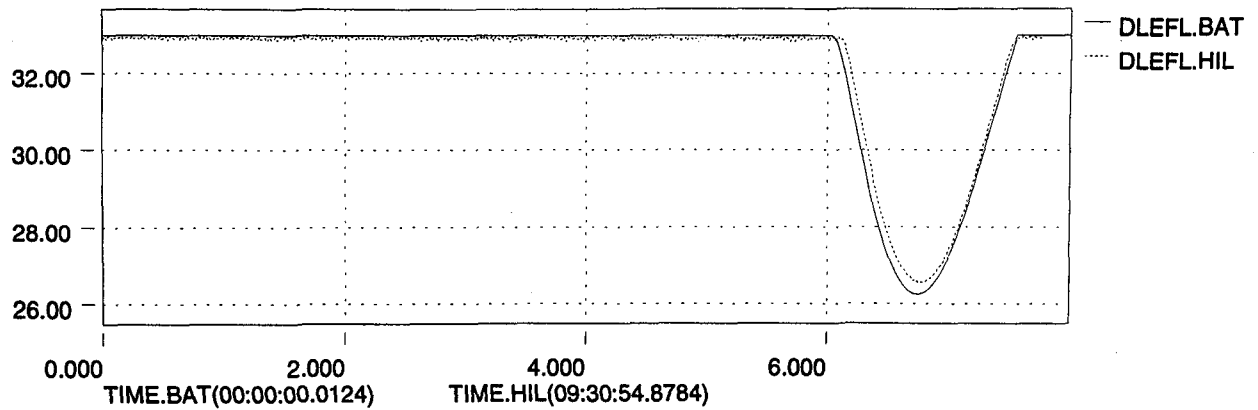
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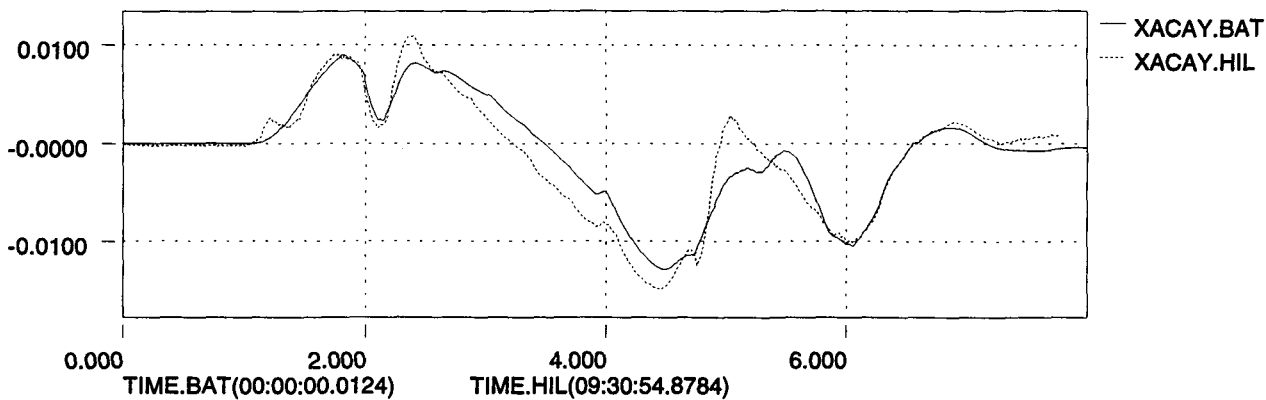
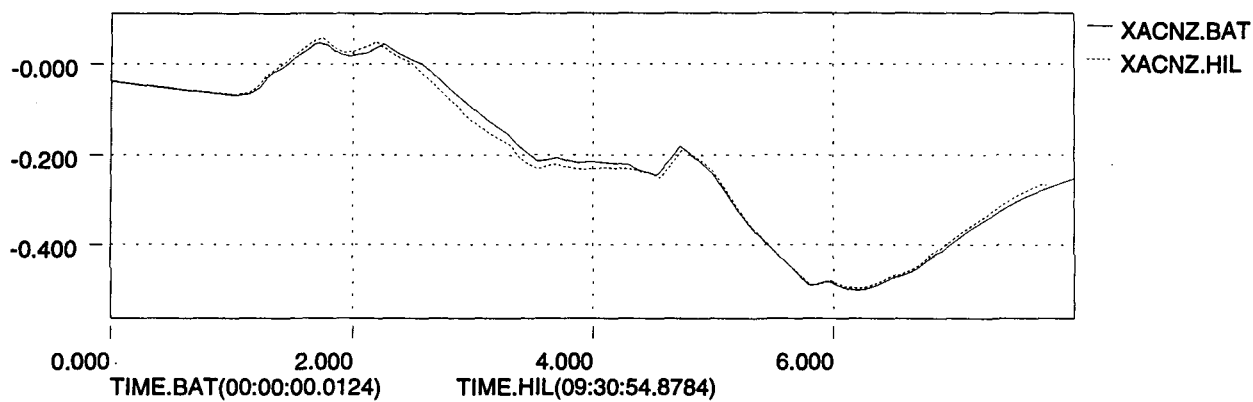
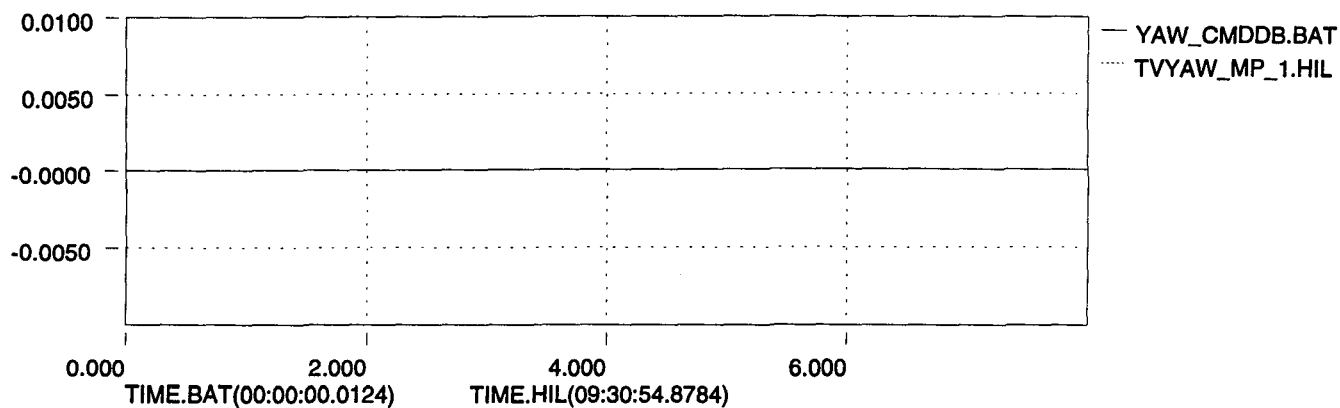
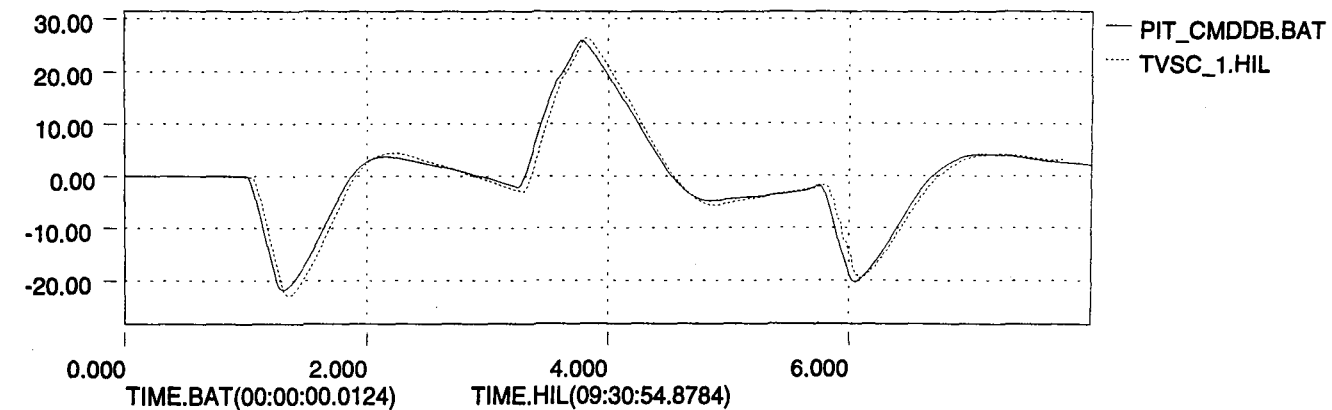
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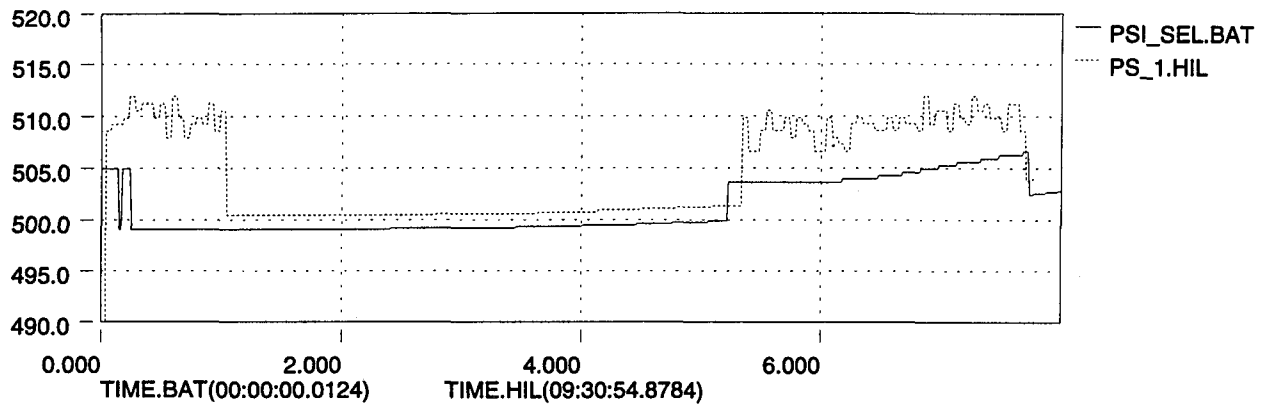
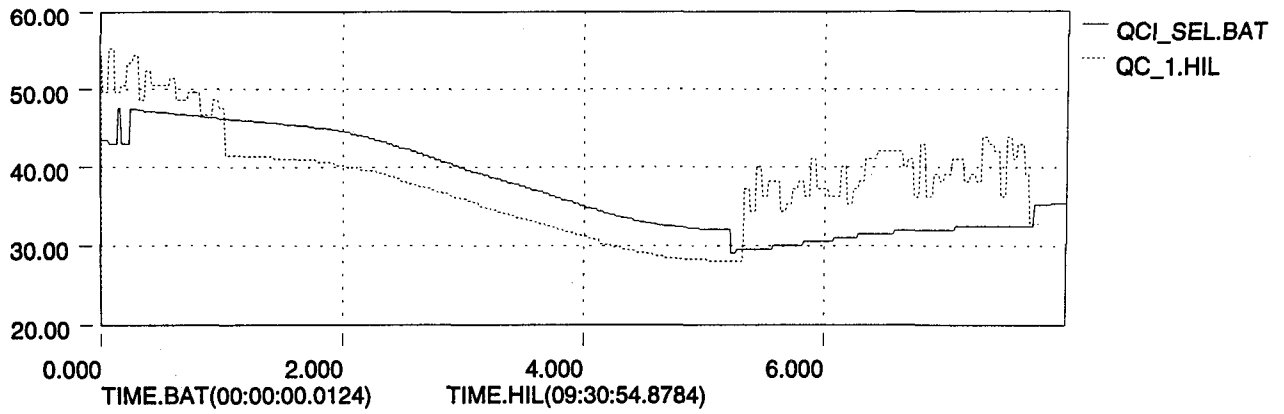
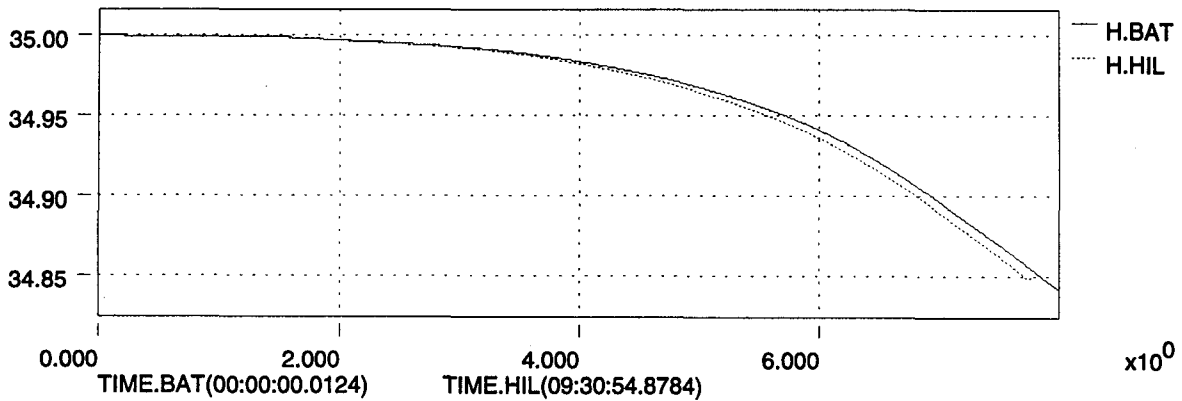
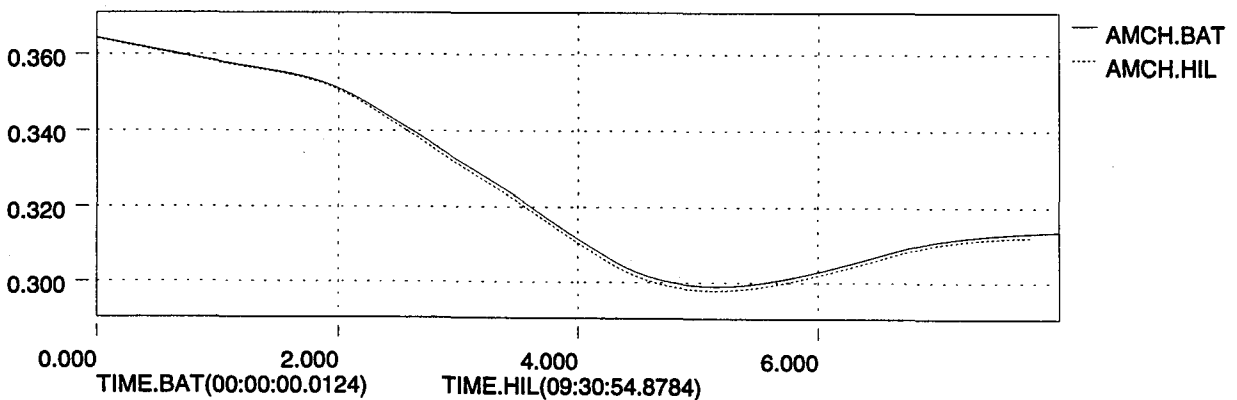


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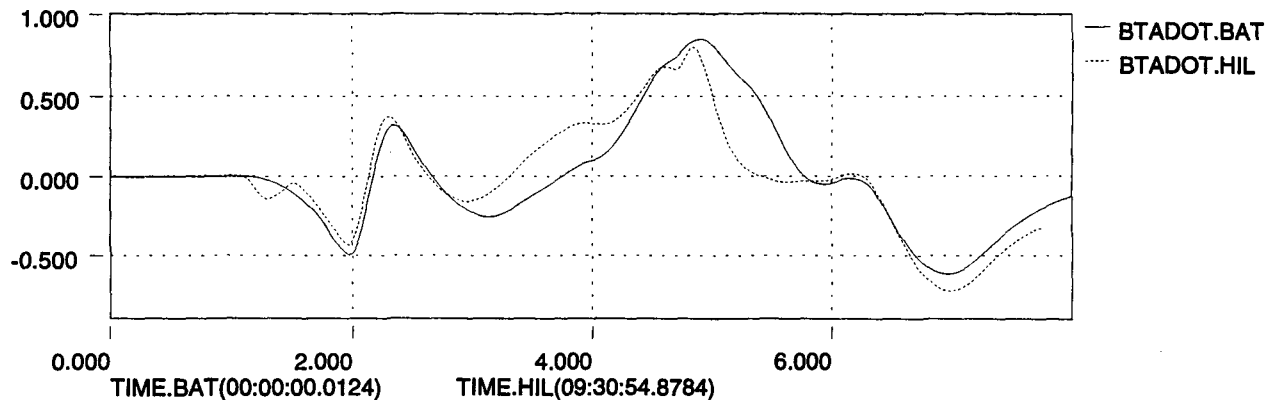
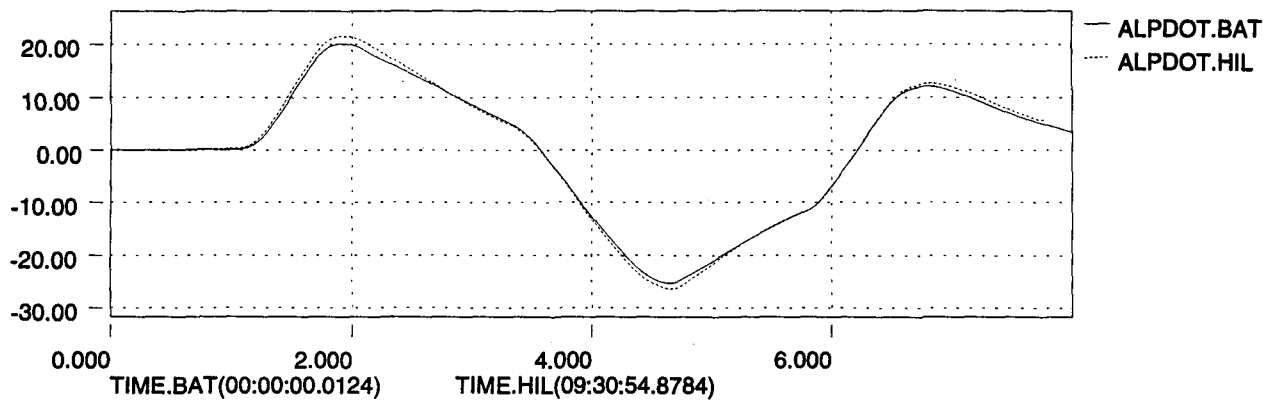
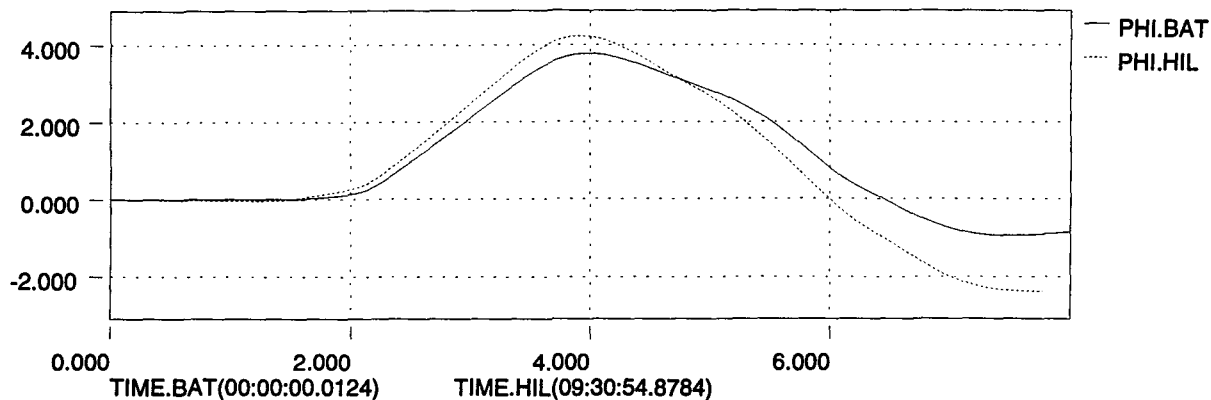
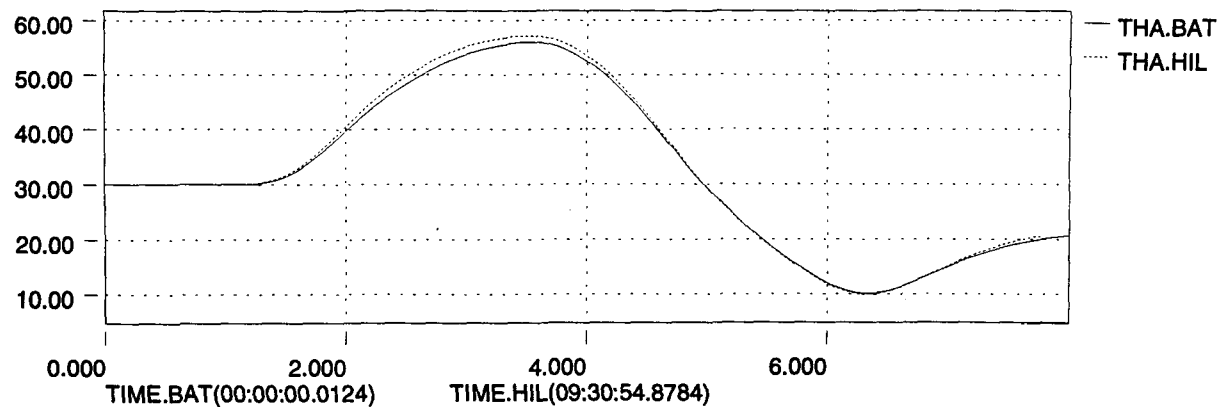


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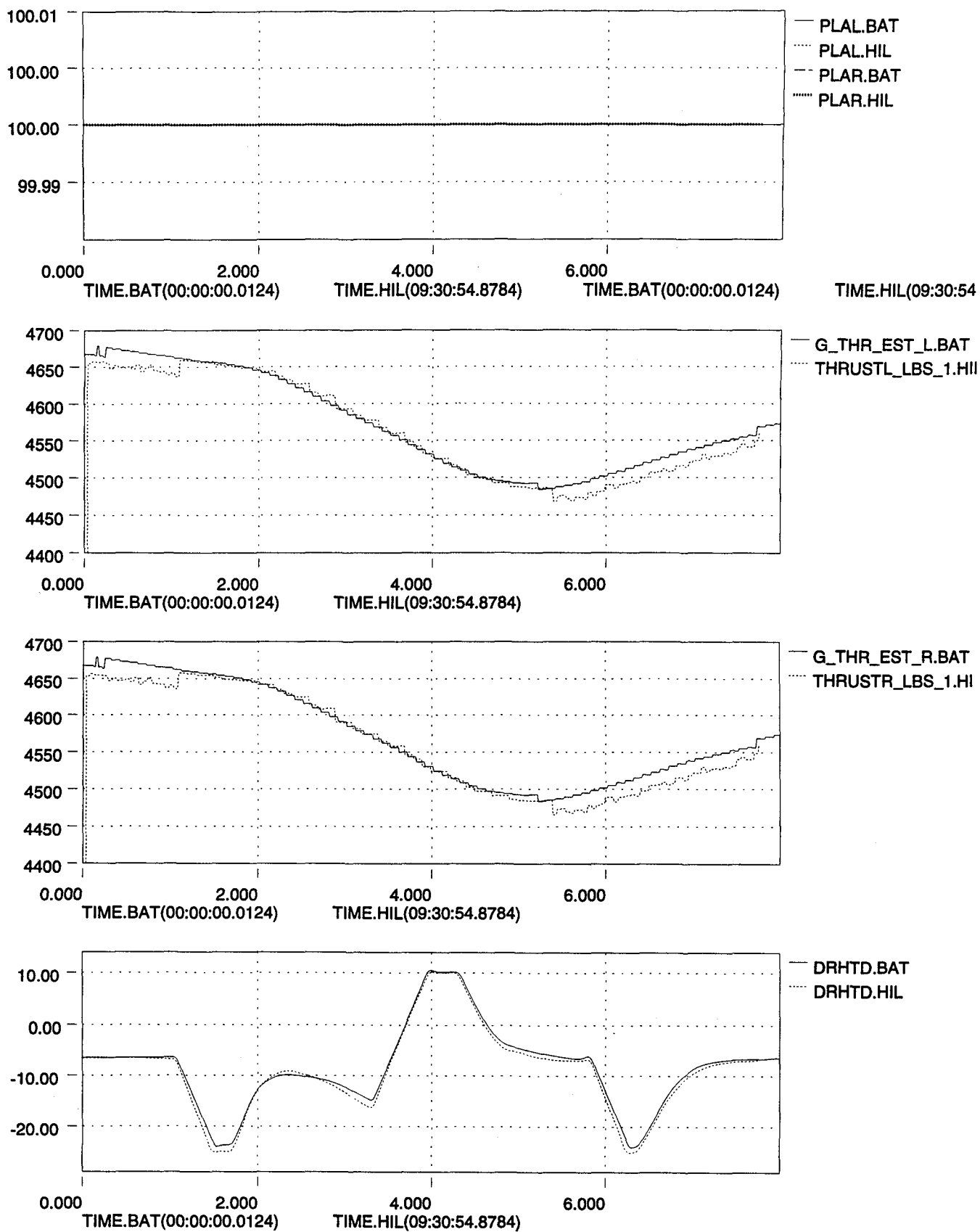
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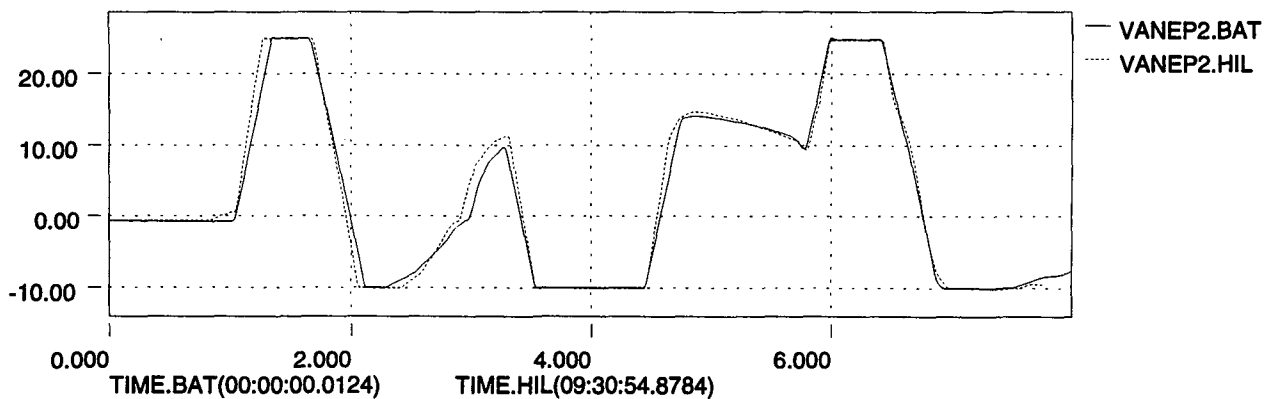
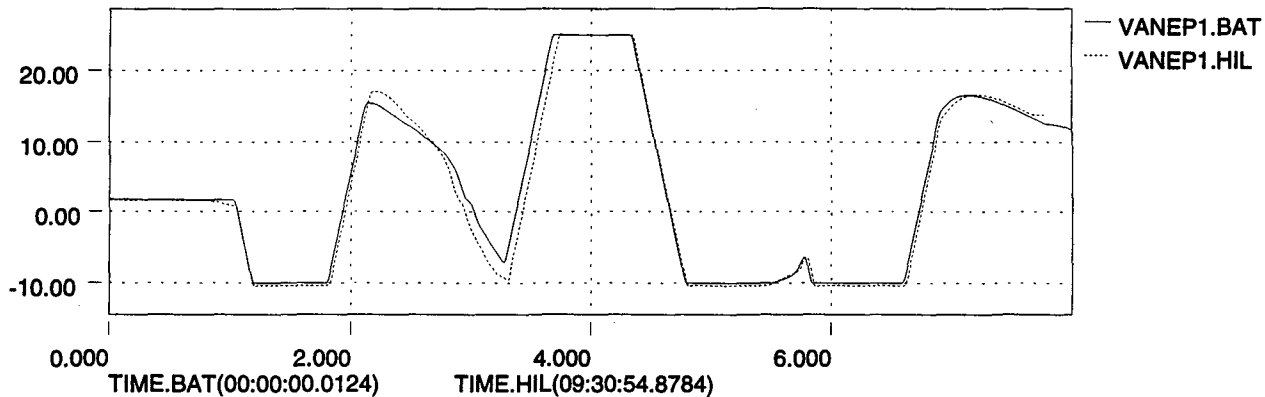
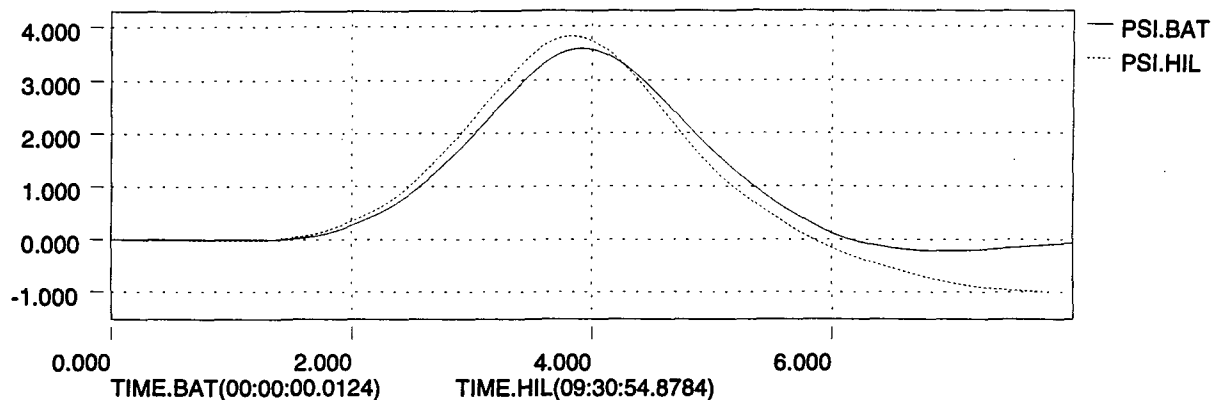
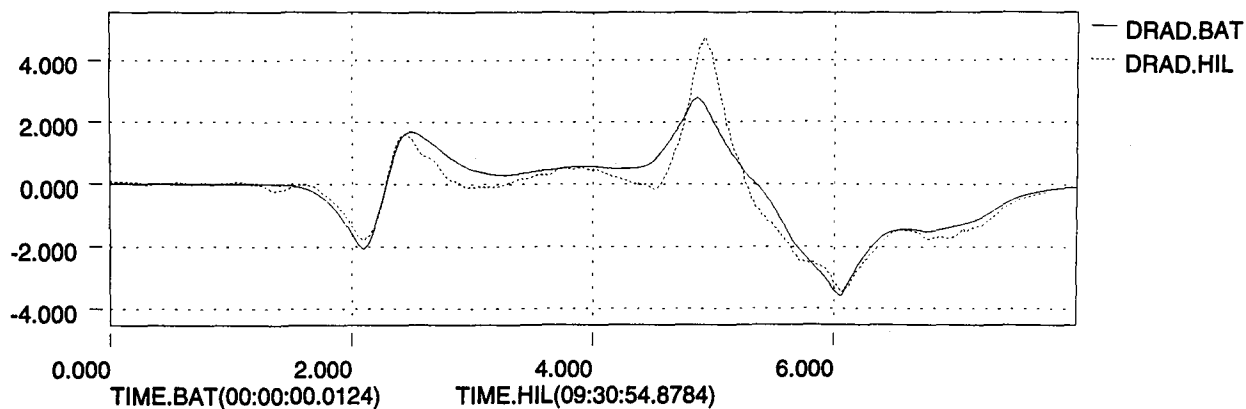
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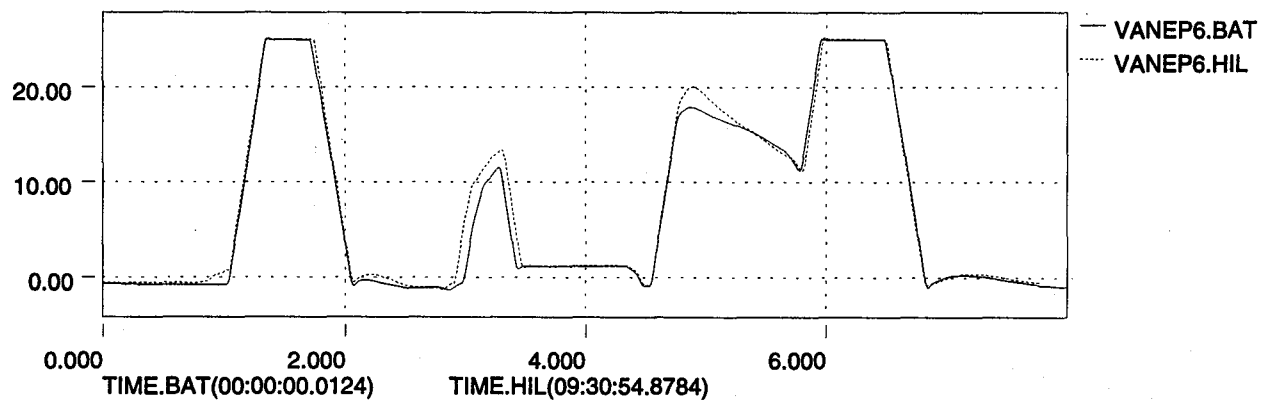
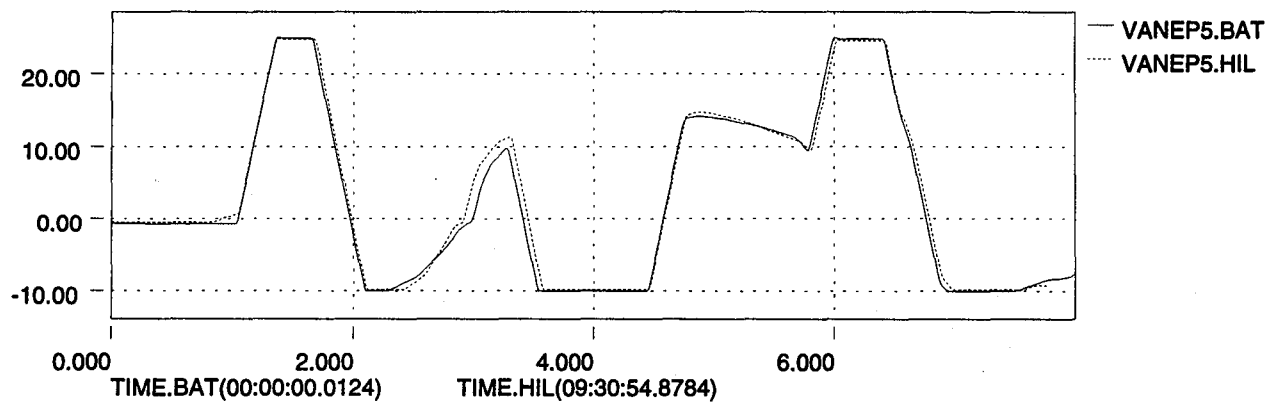
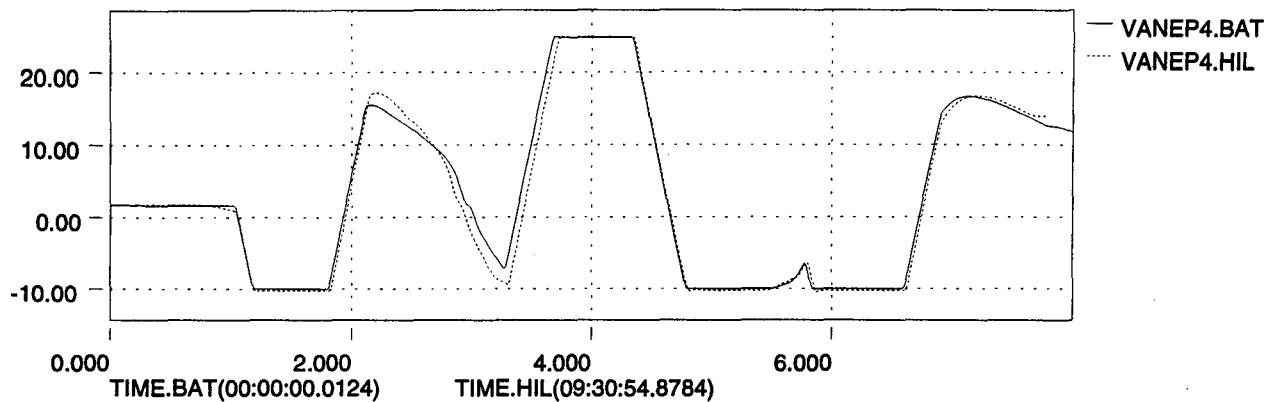
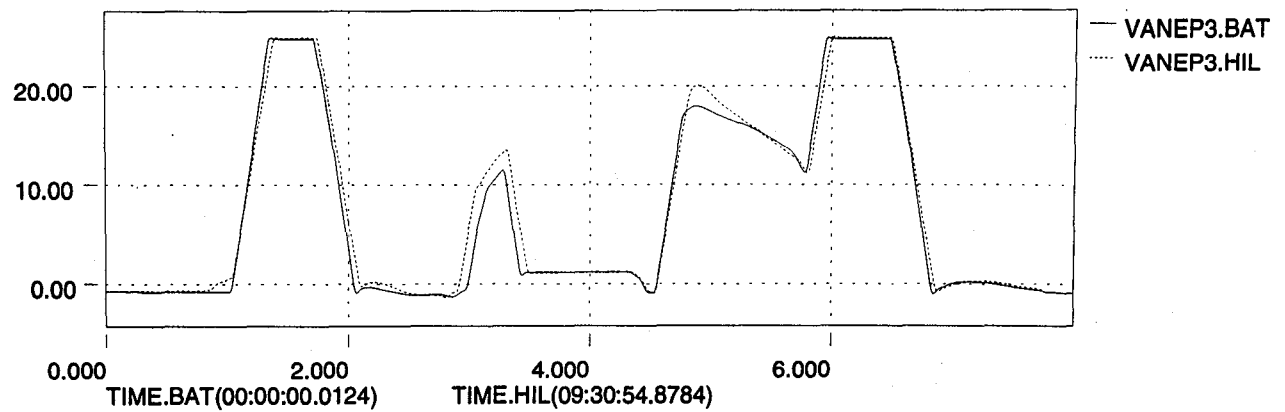
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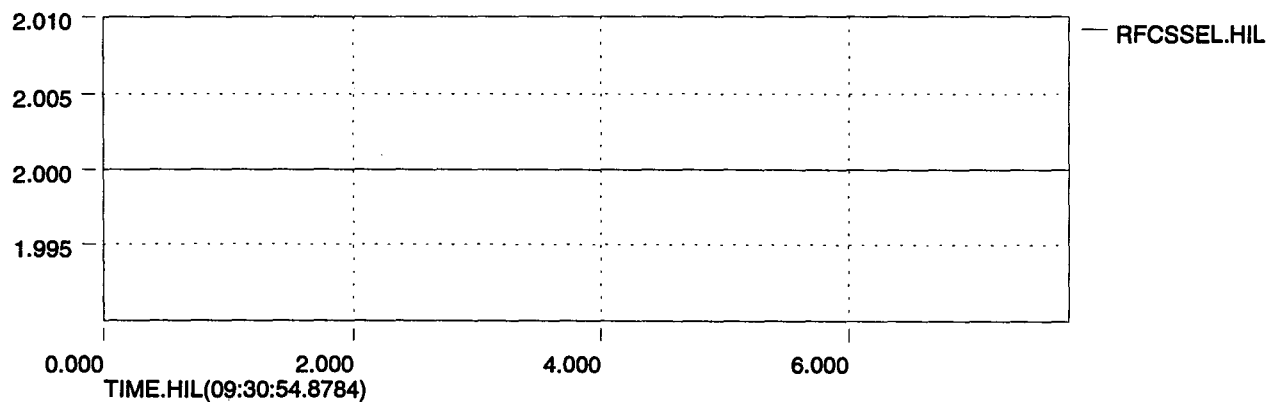
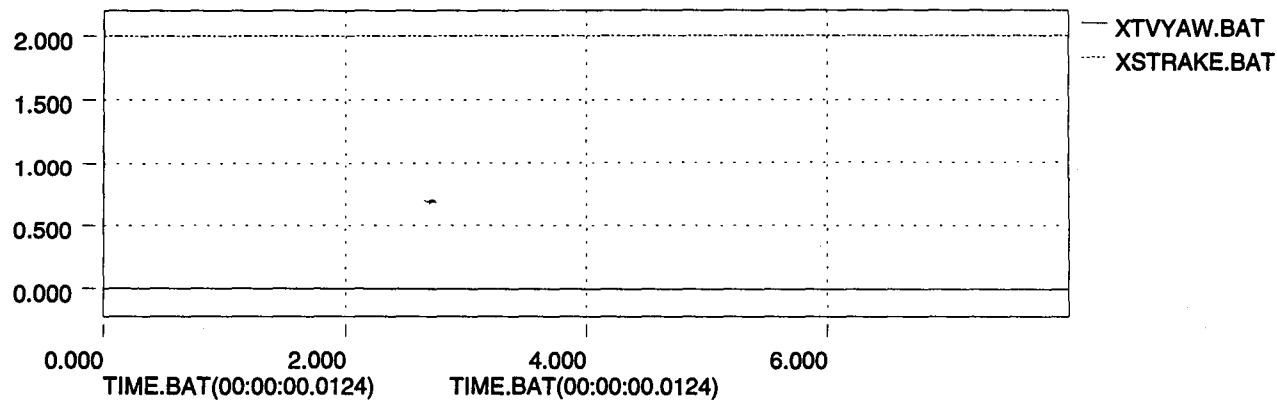
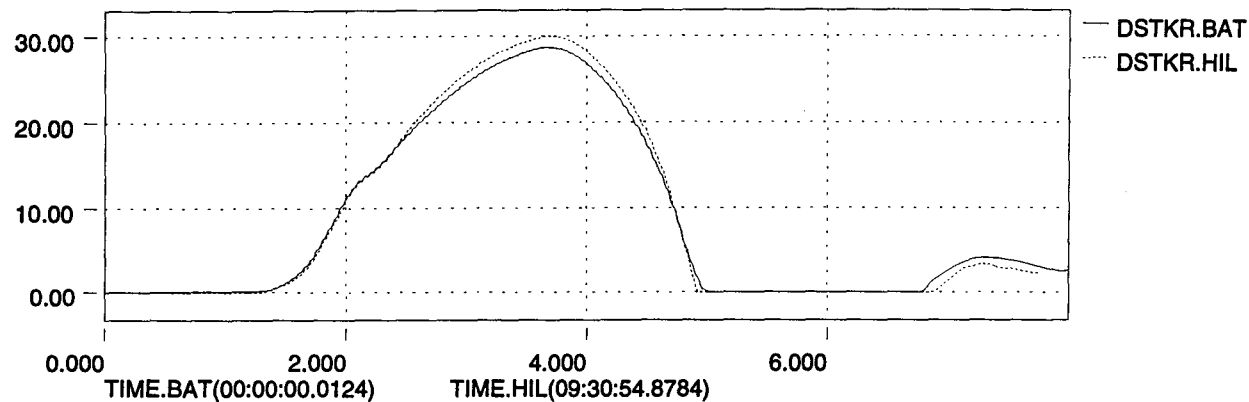
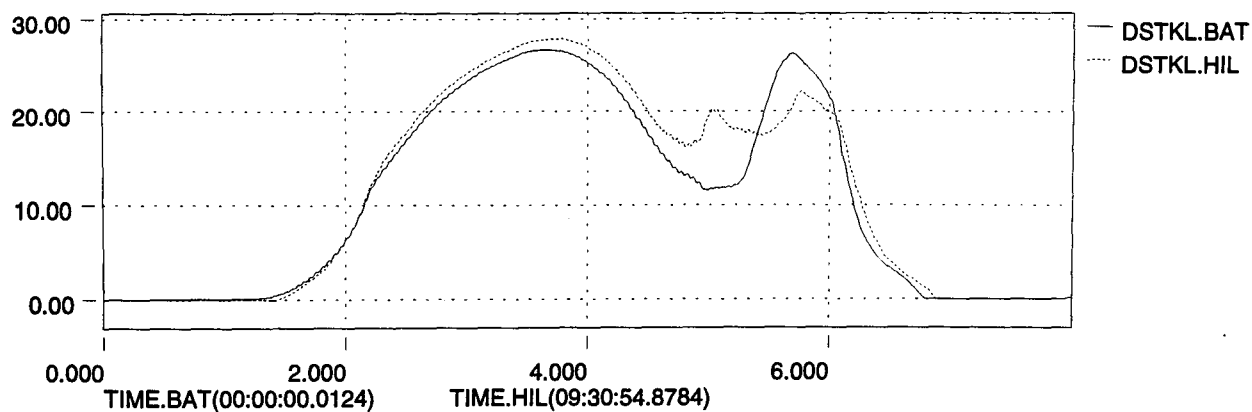
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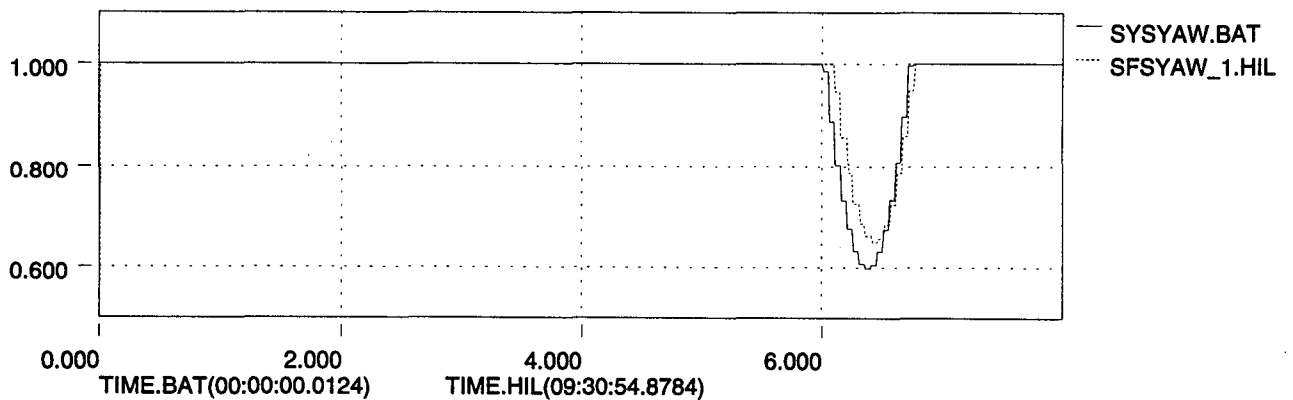
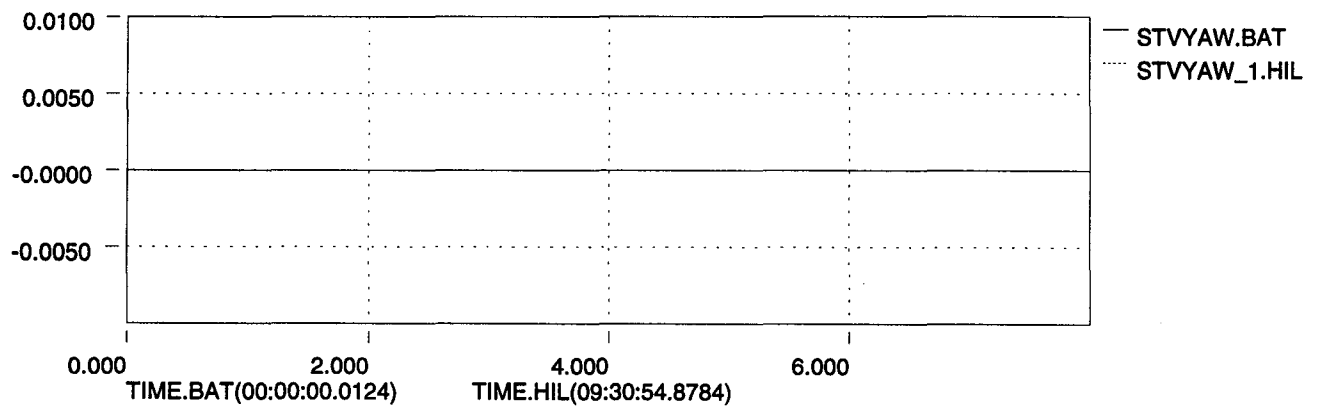
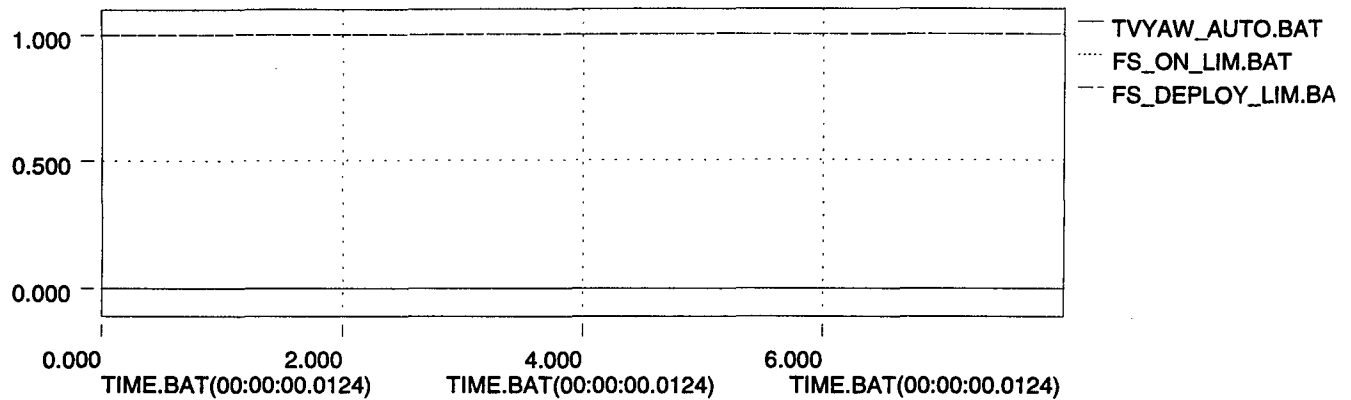
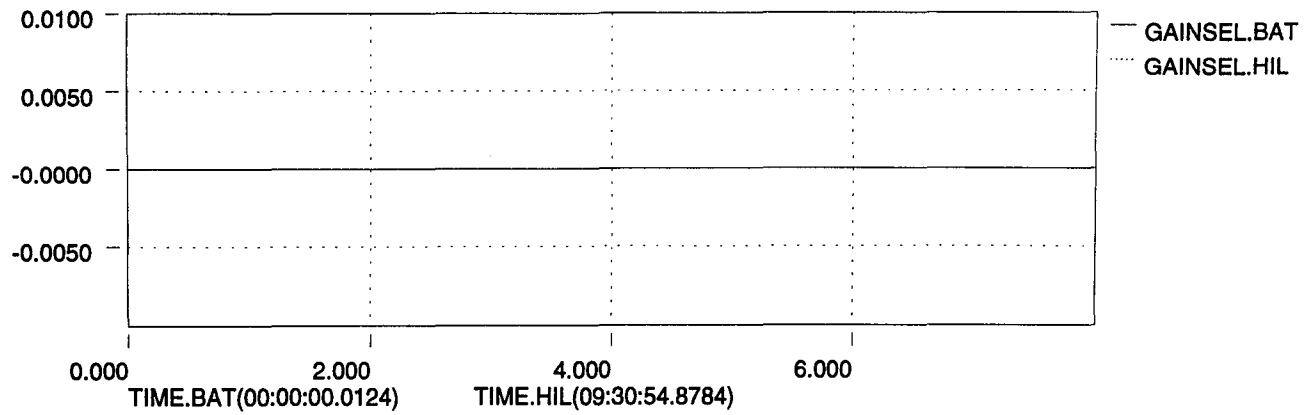
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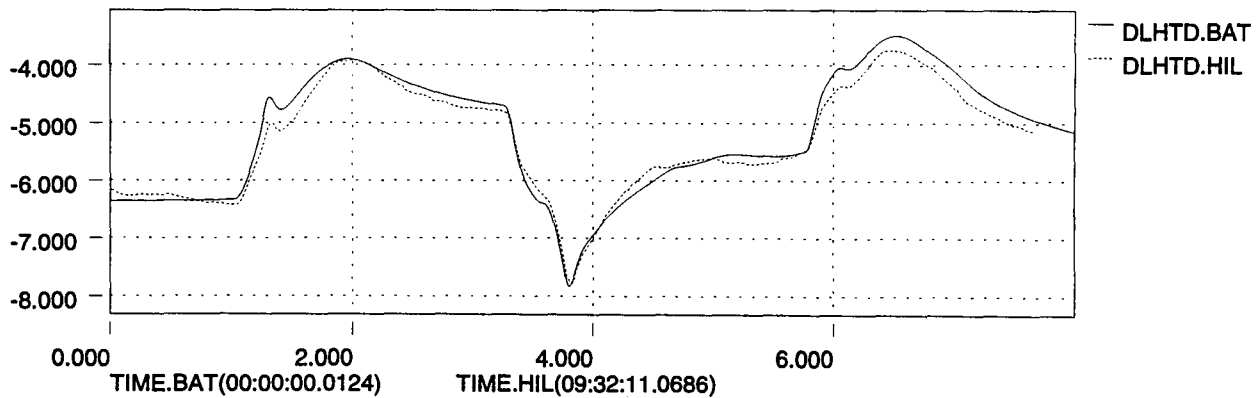
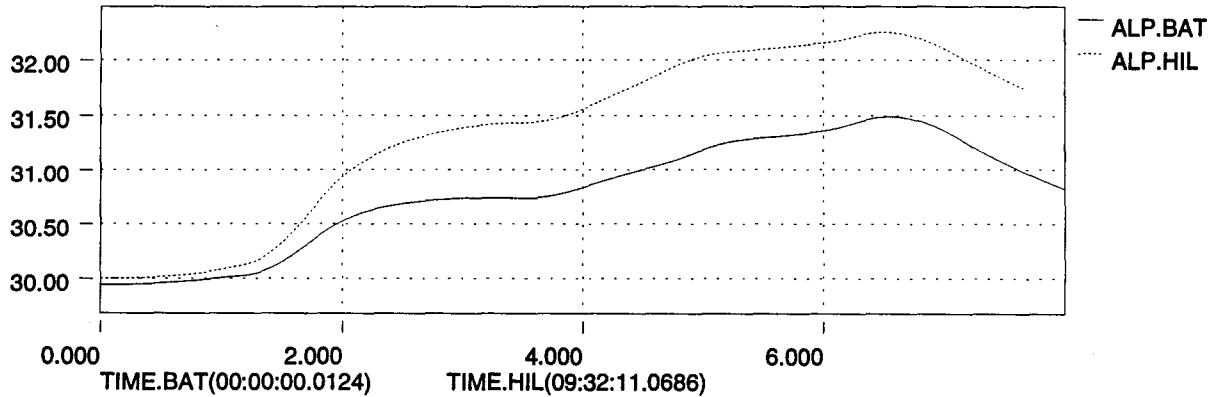
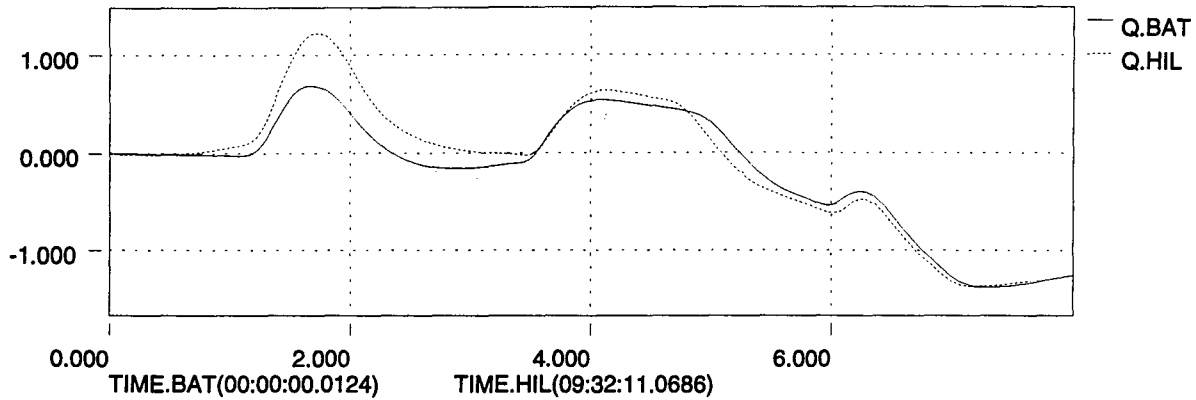
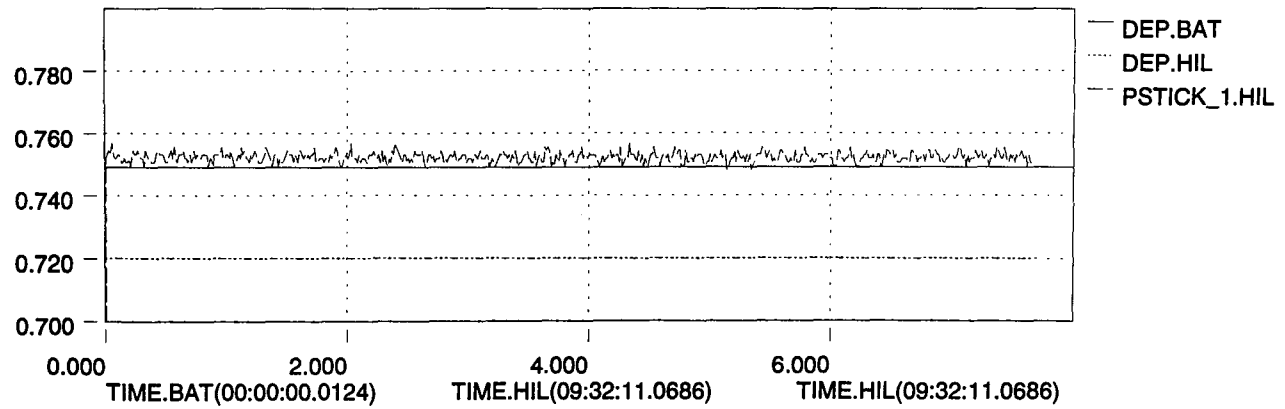
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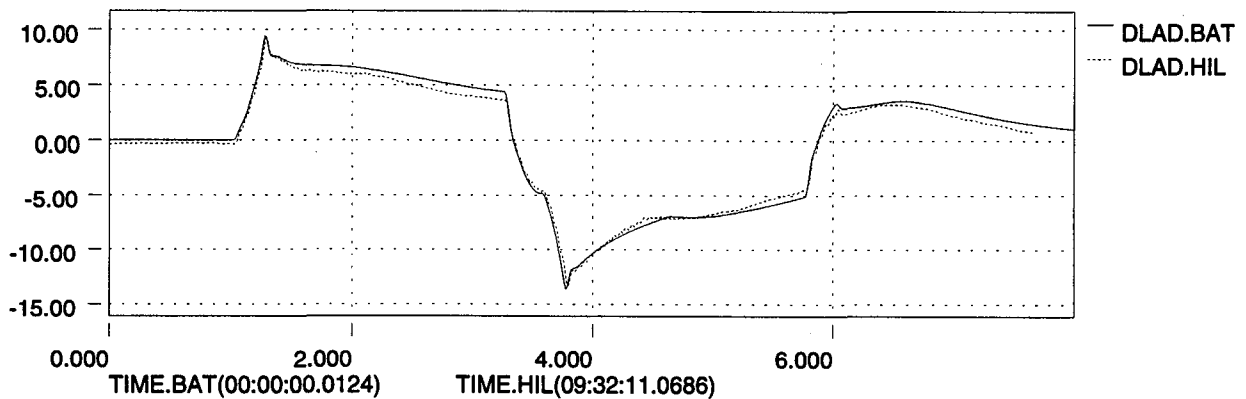
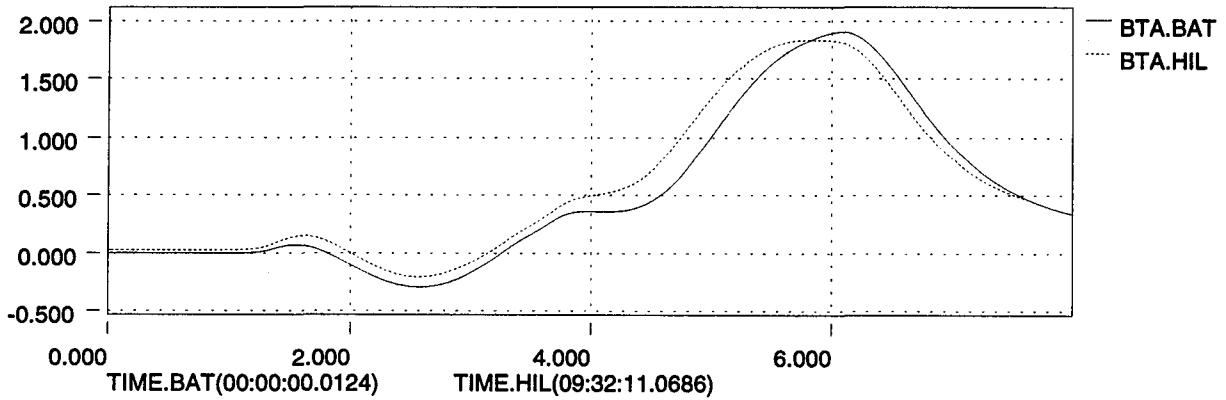
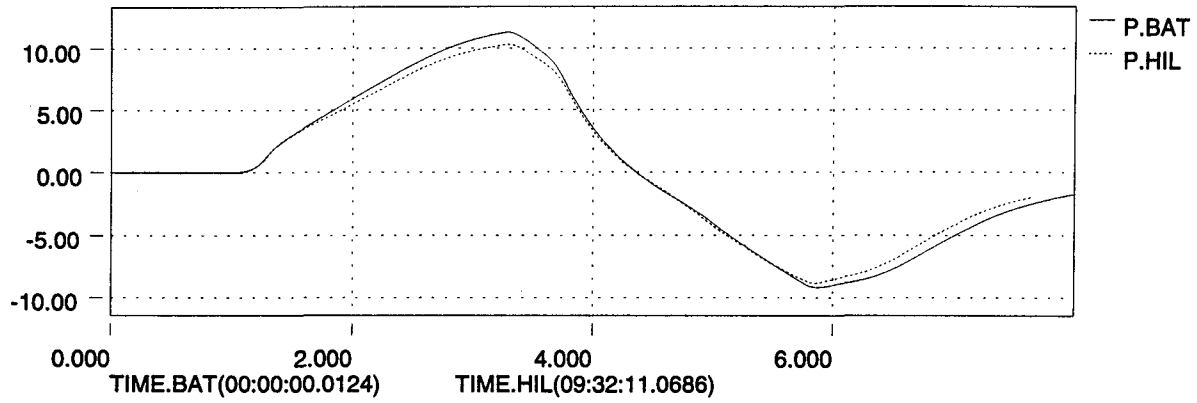
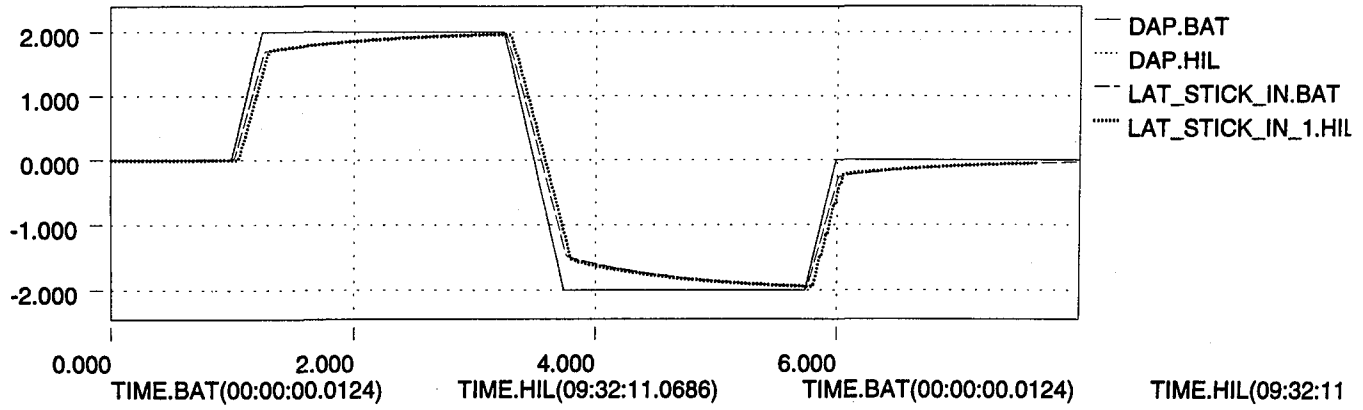
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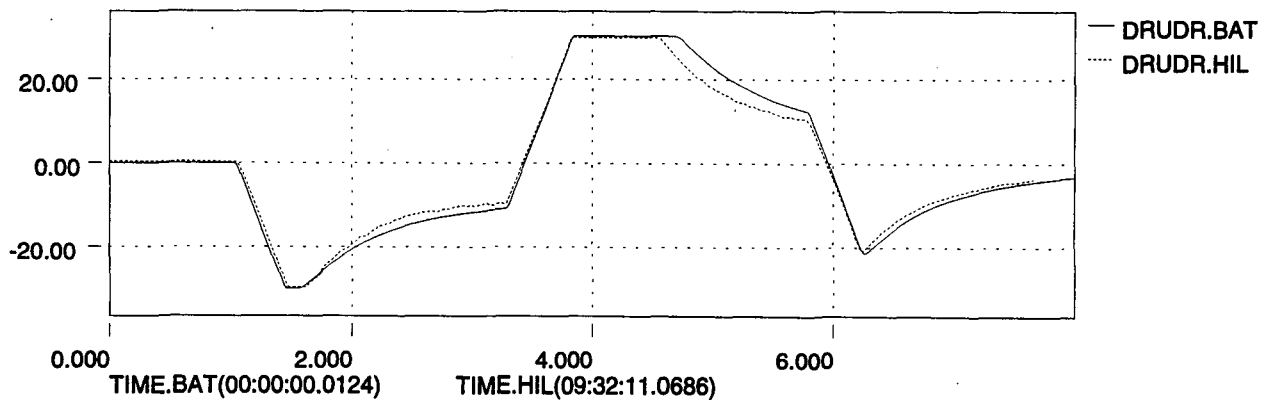
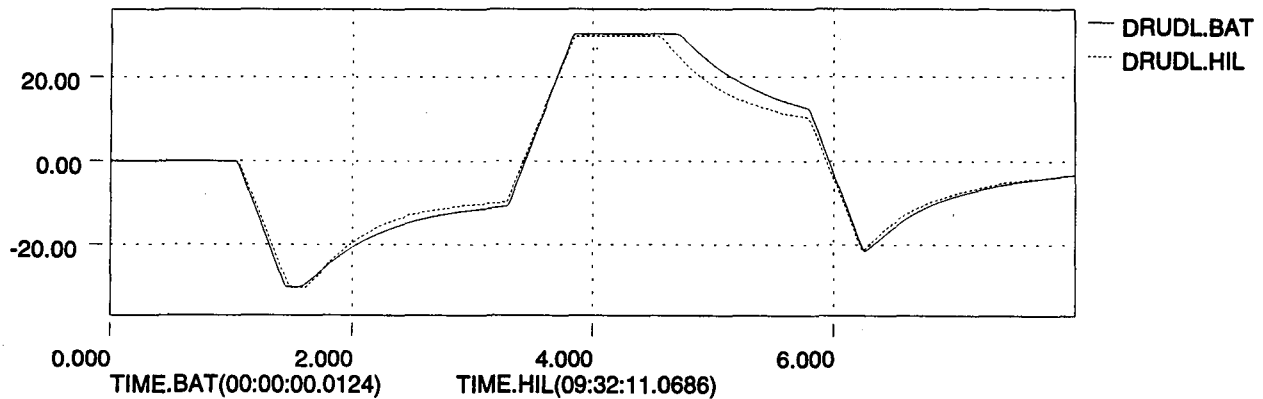
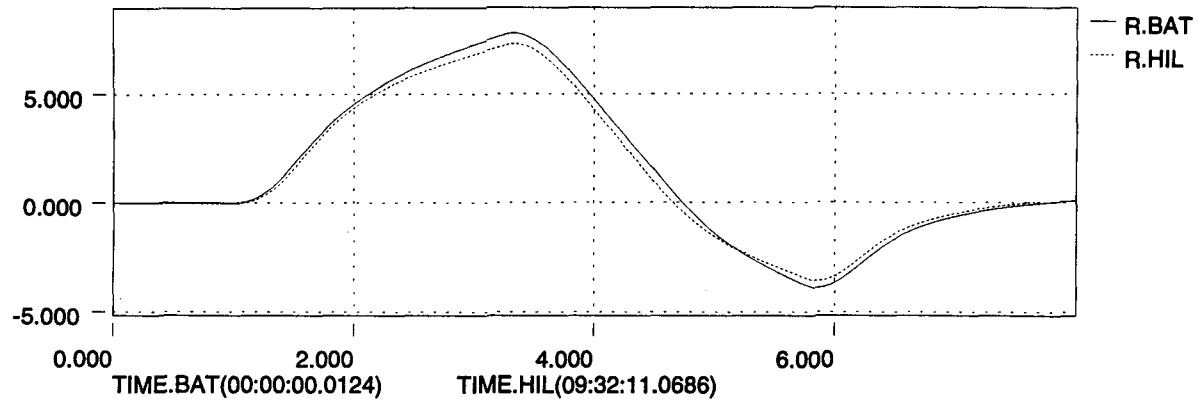
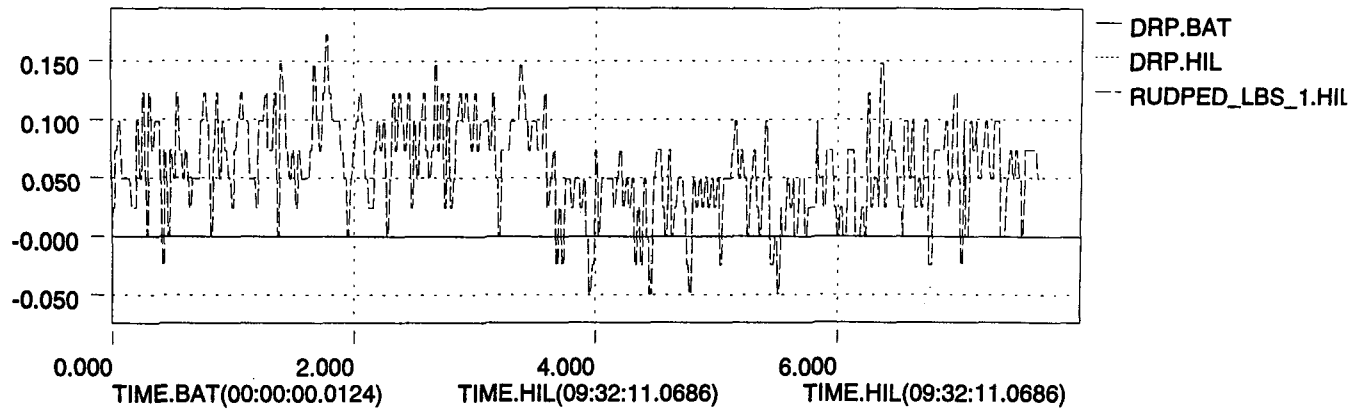
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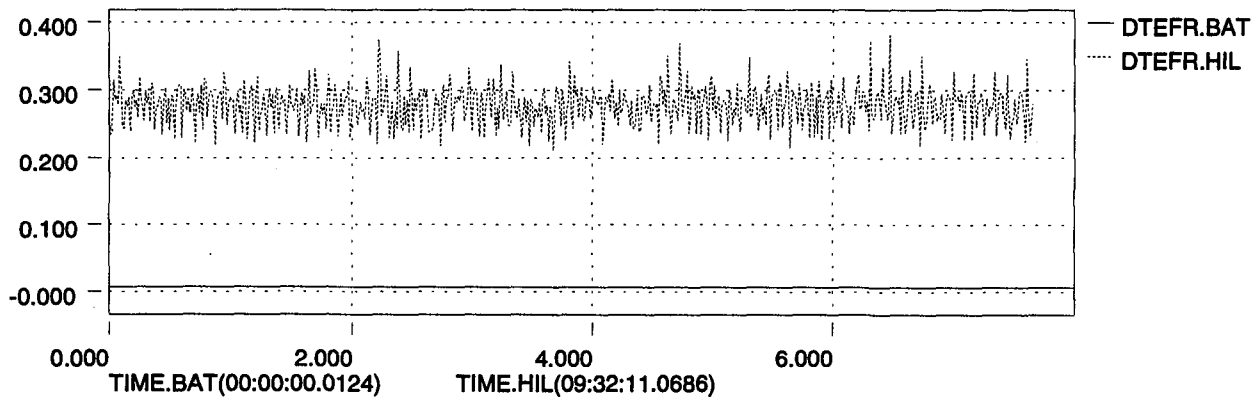
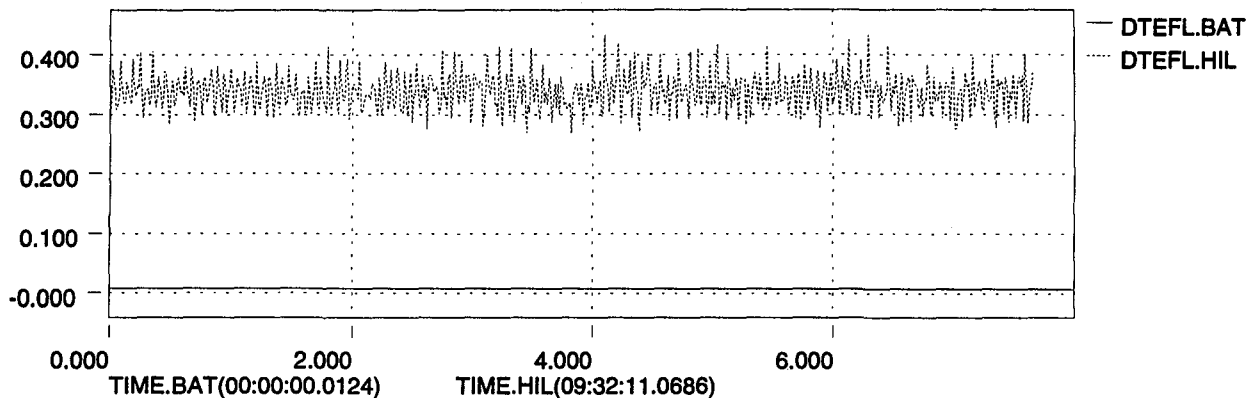
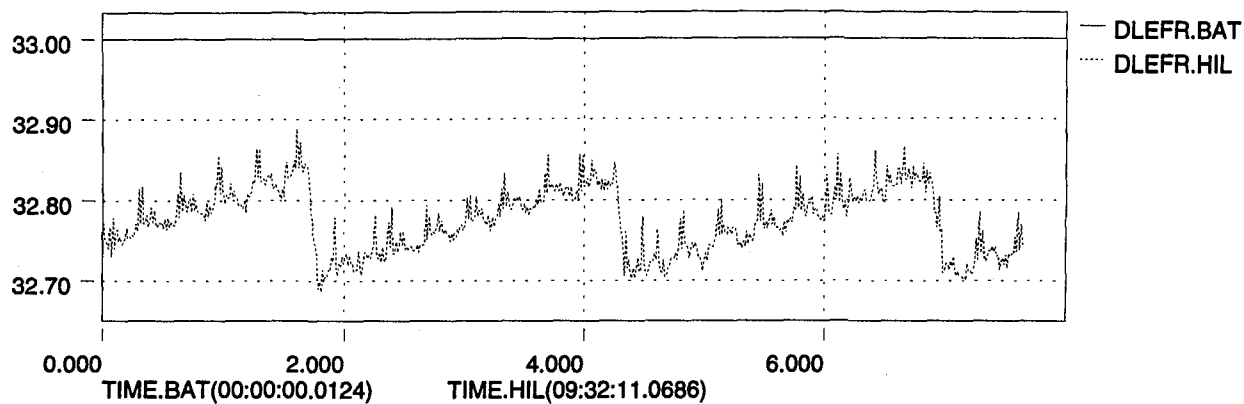
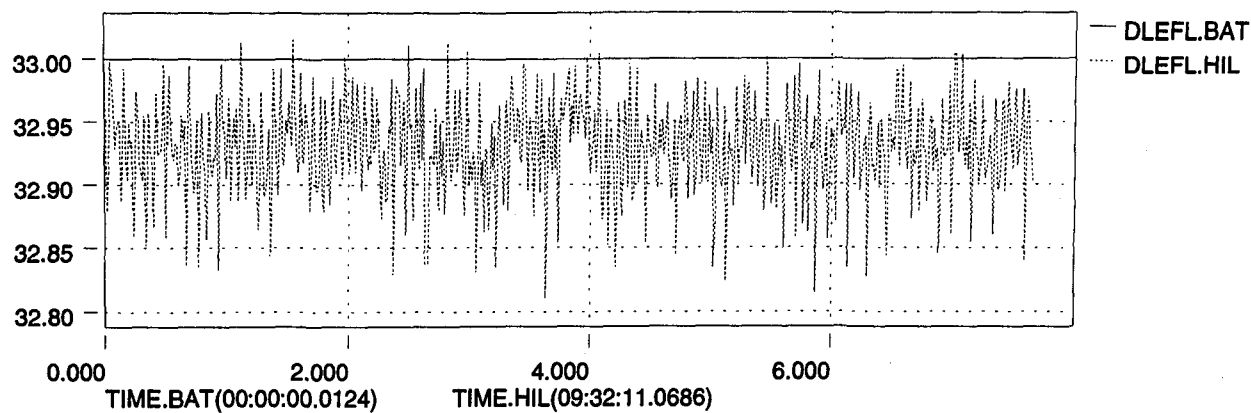
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268



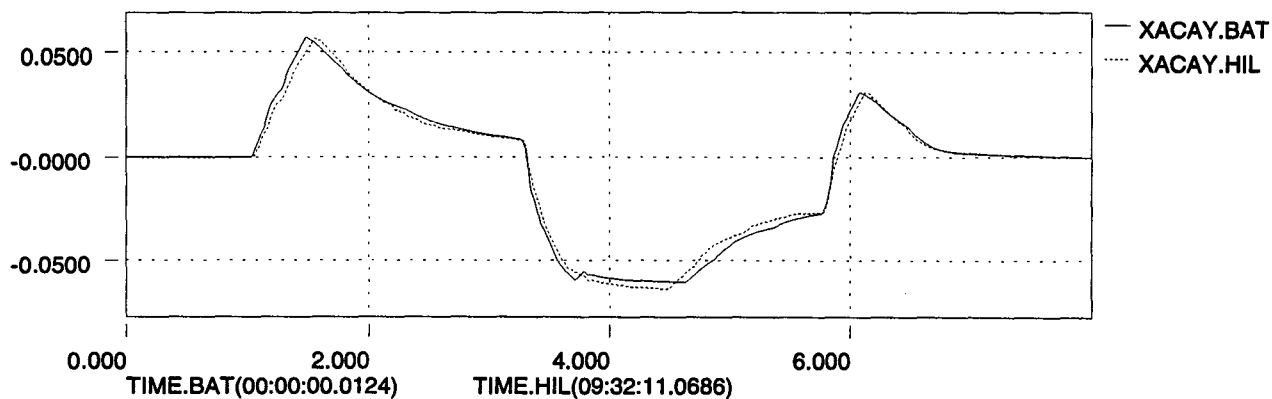
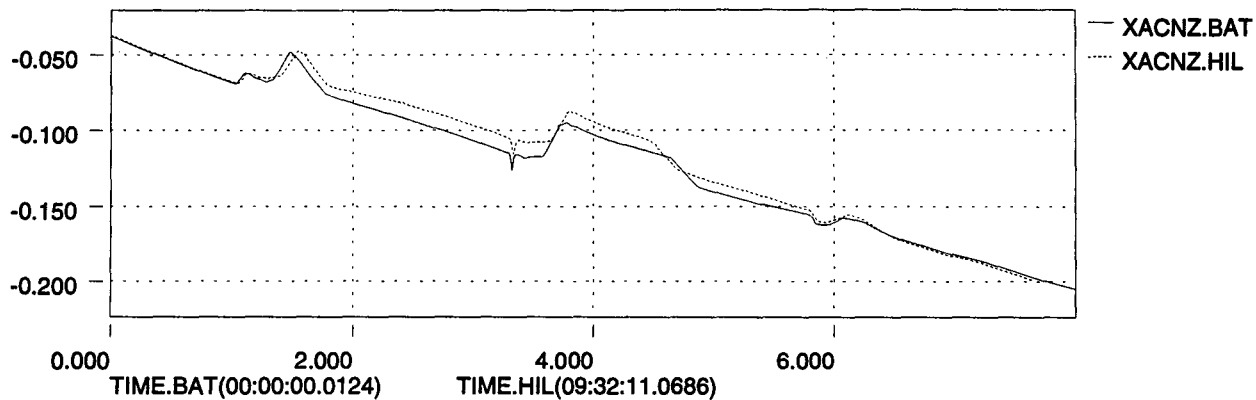
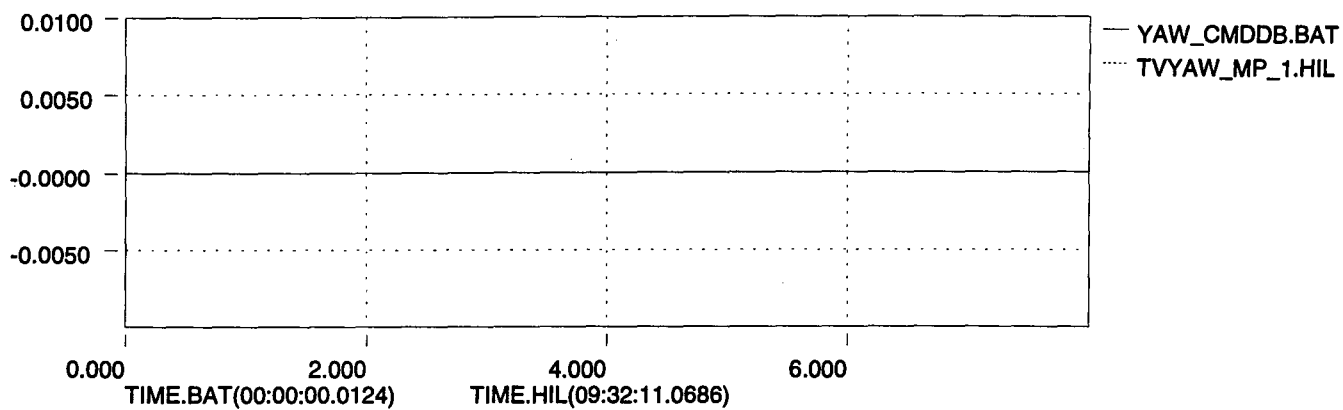
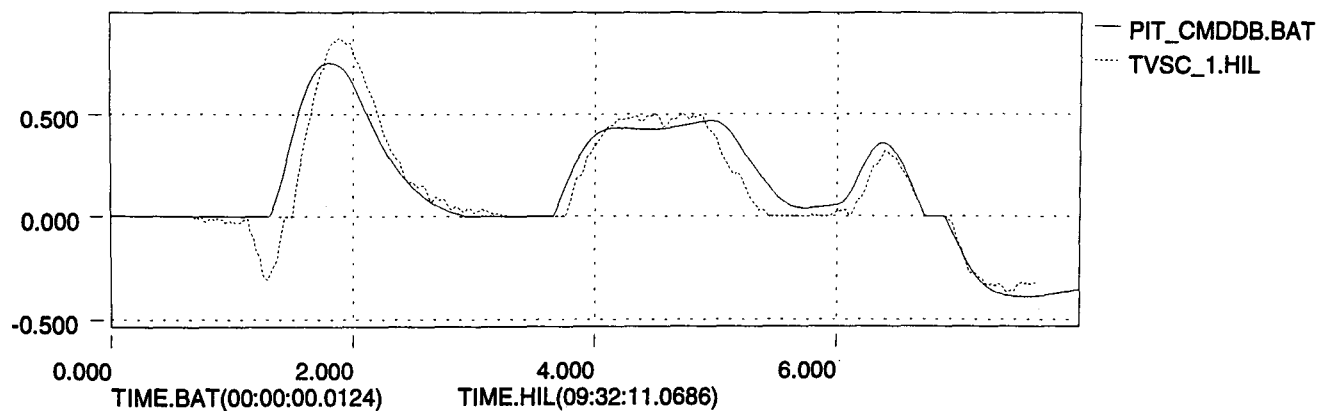
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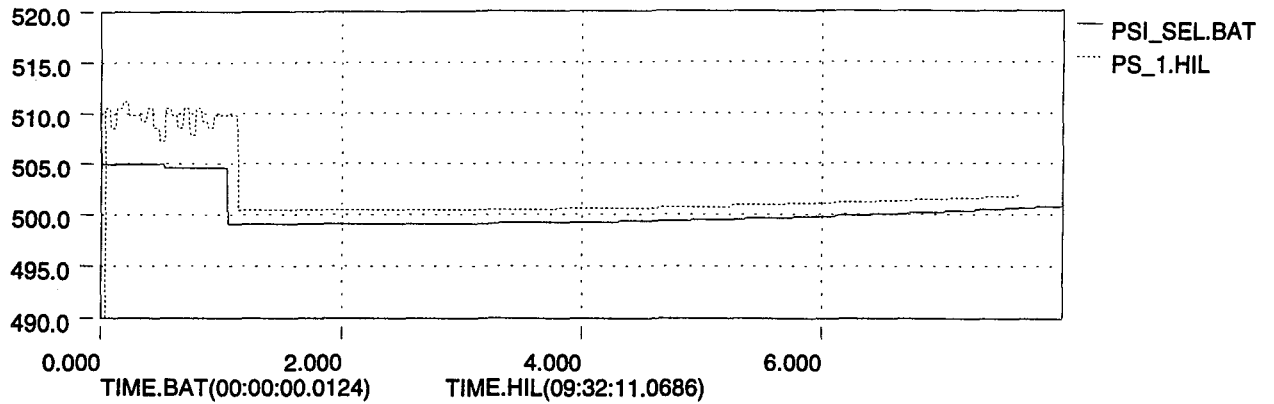
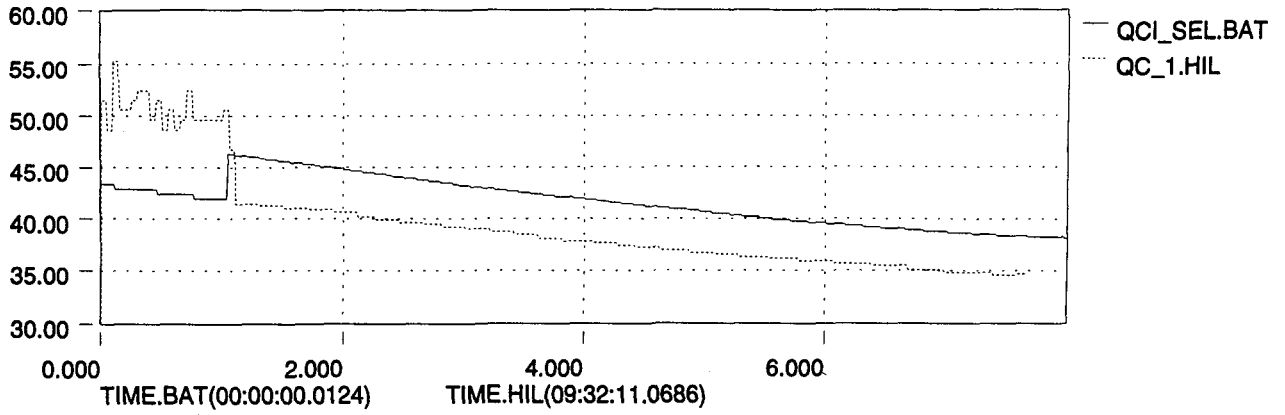
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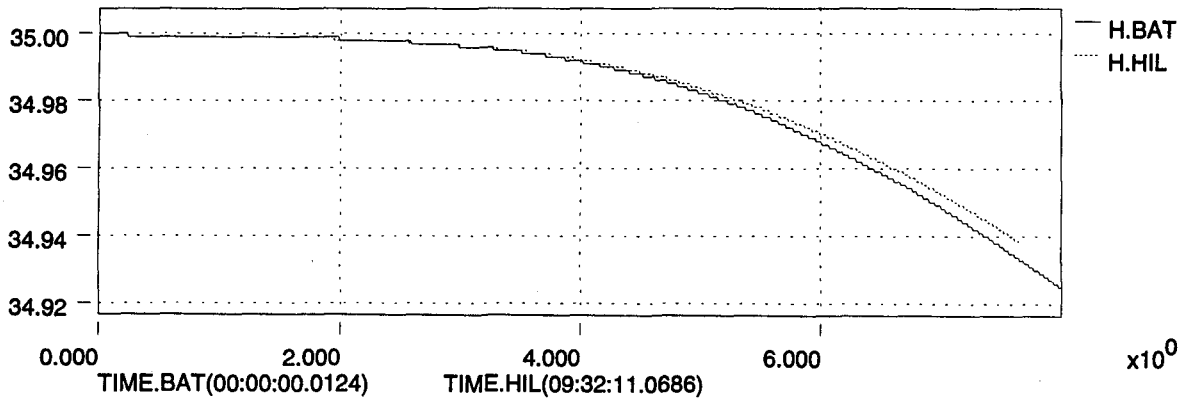


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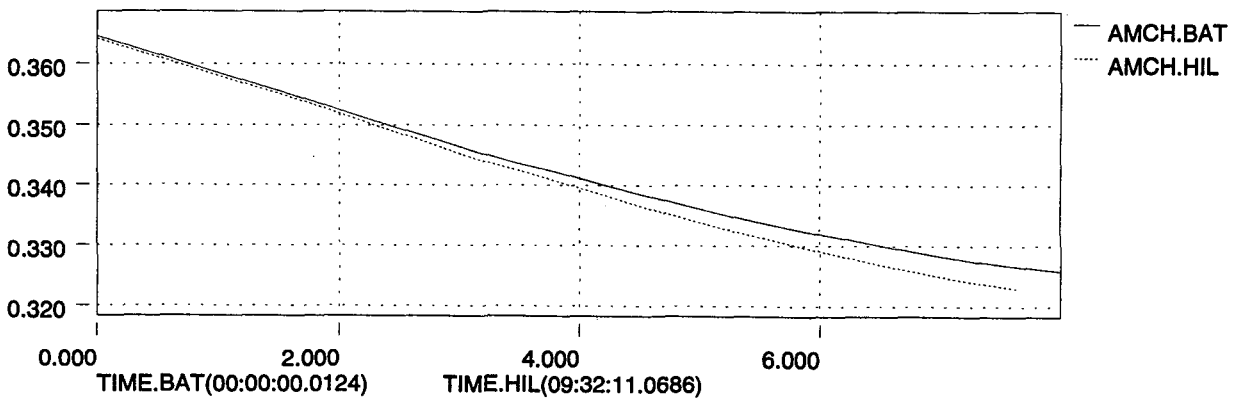
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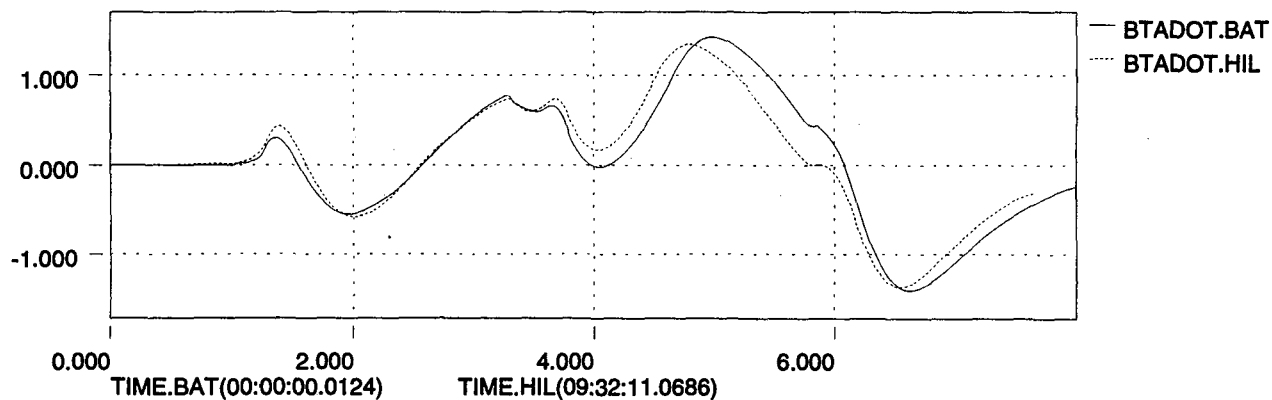
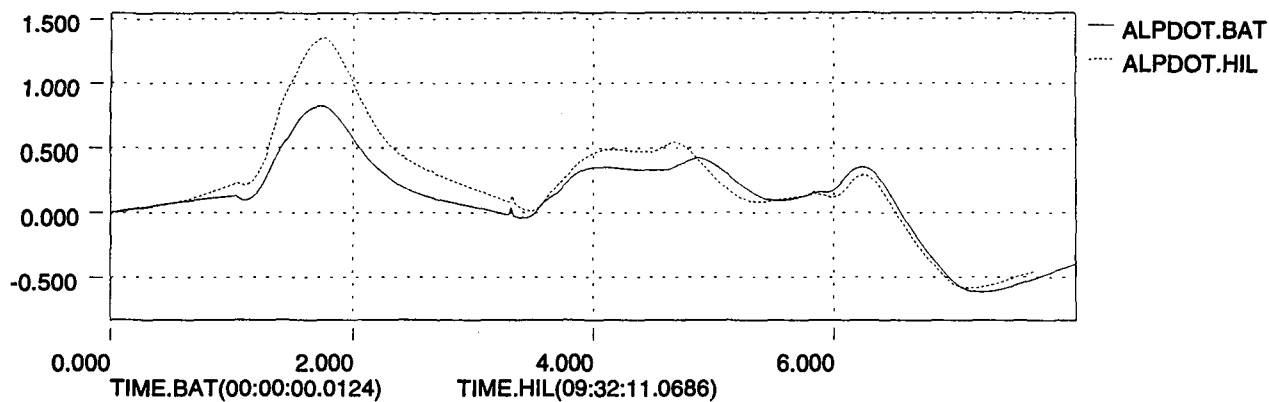
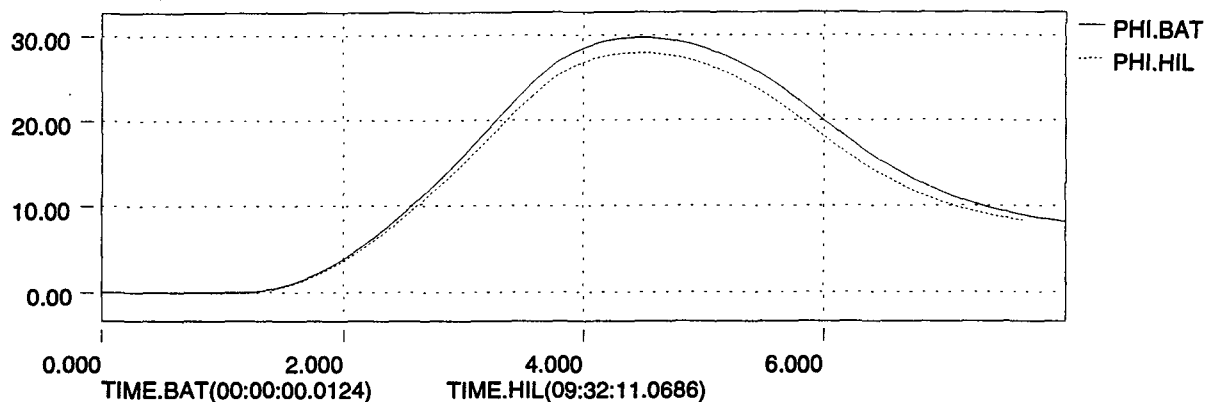
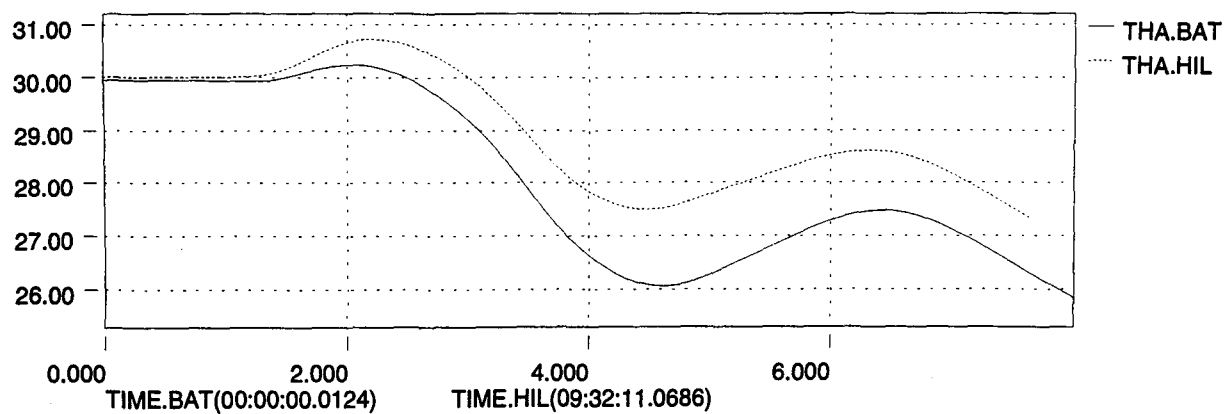


$\times 10^0$



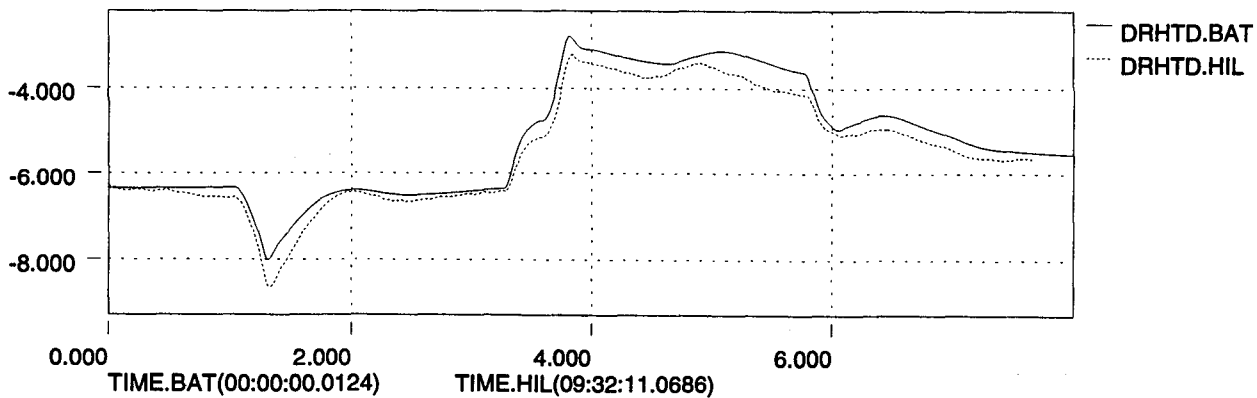
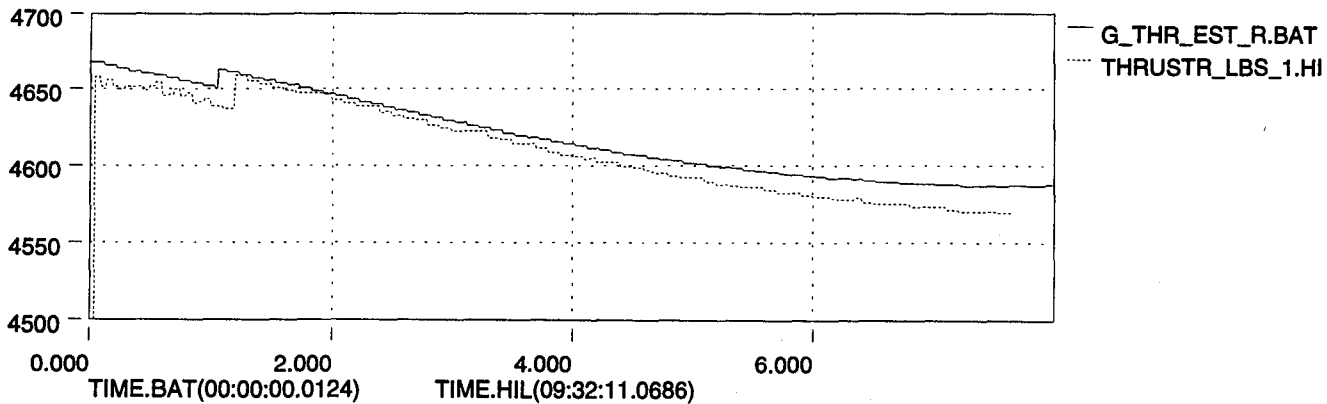
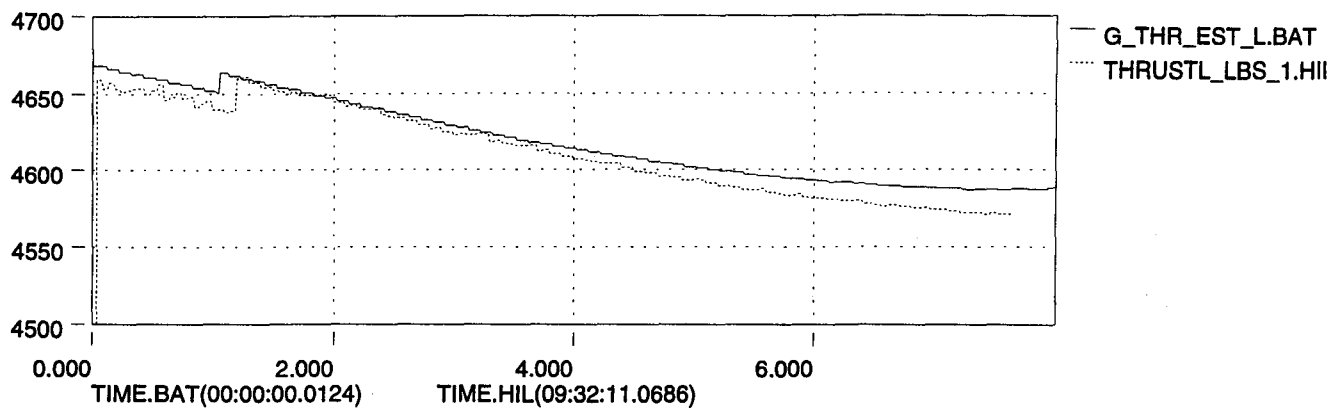
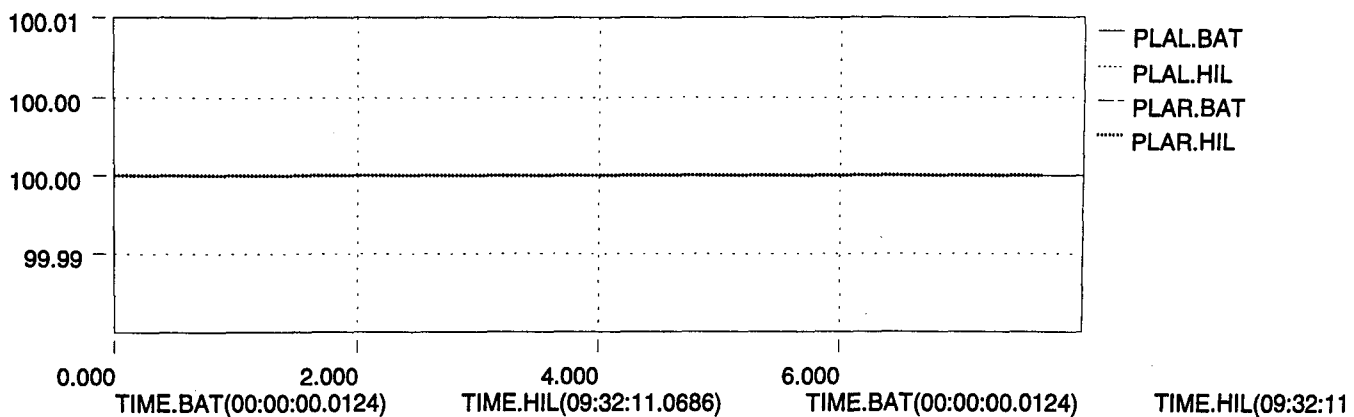
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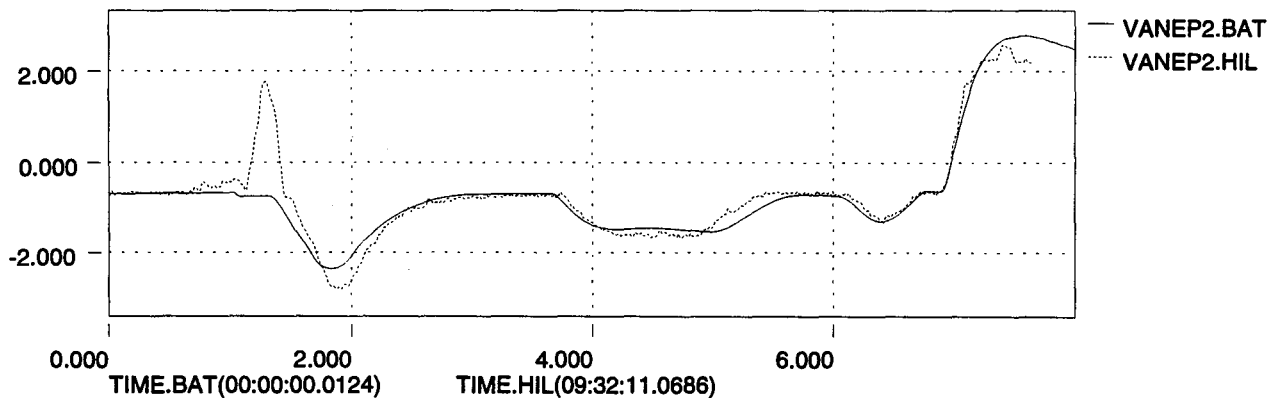
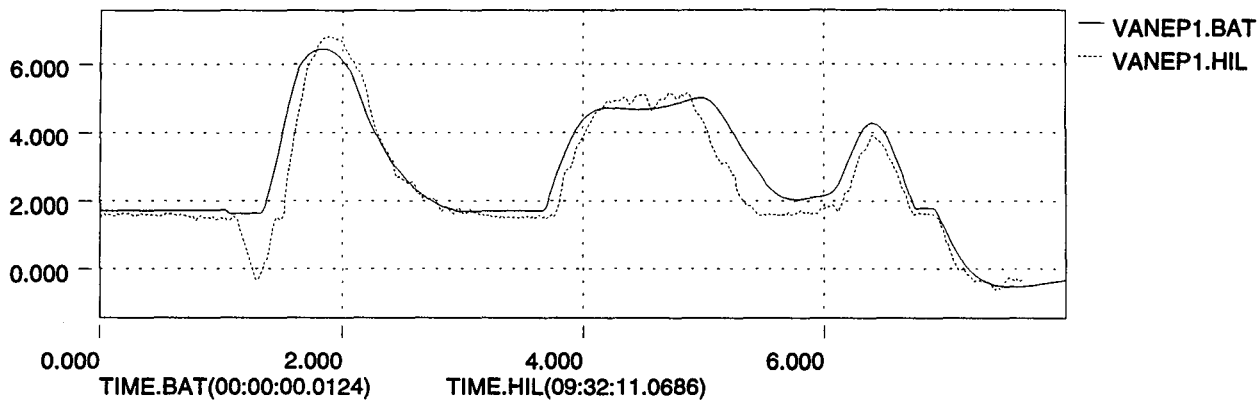
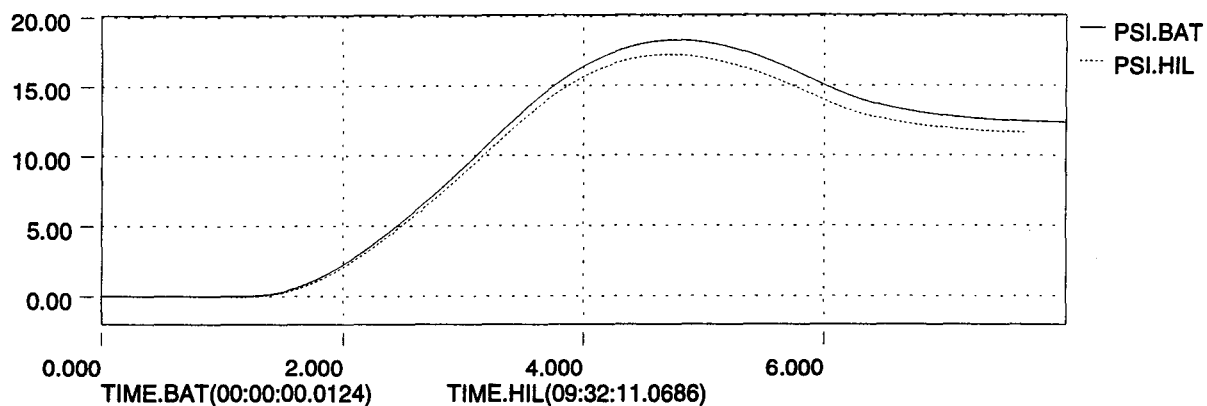
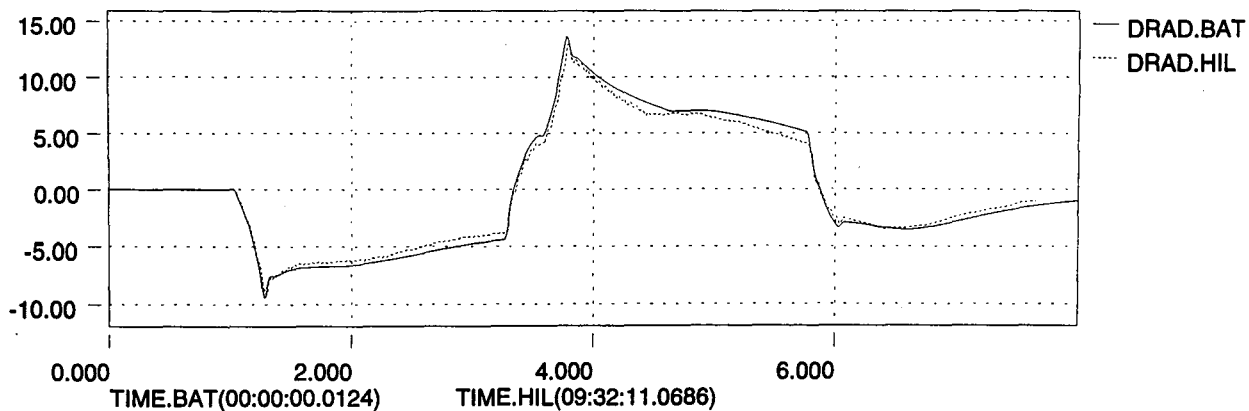


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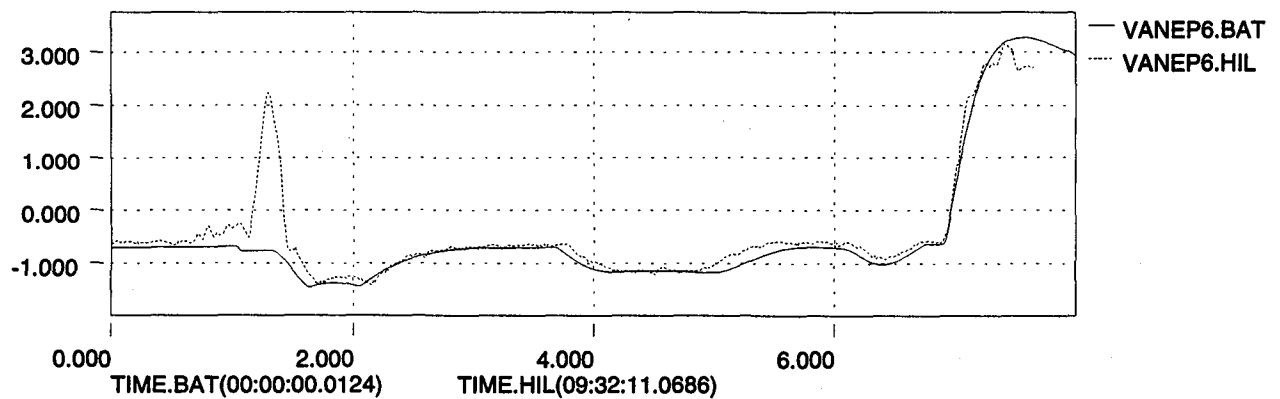
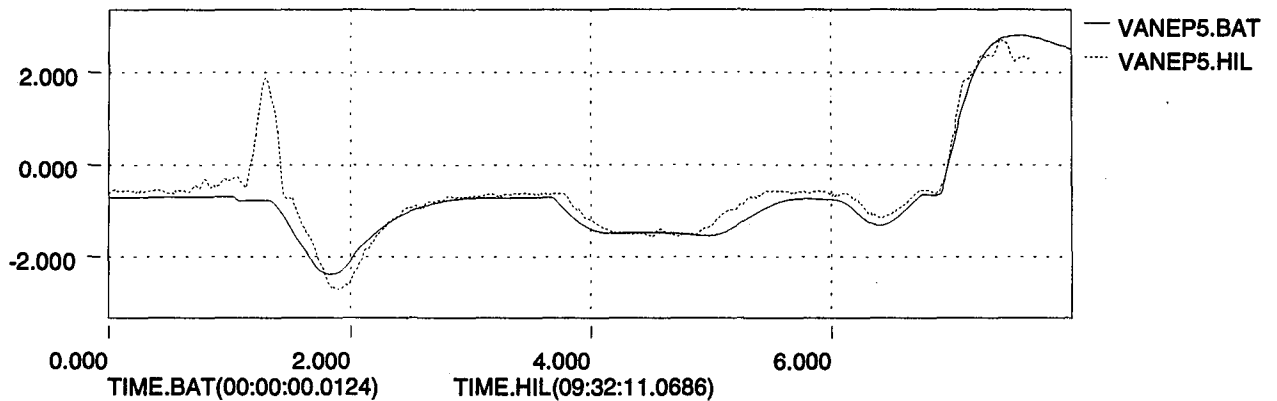
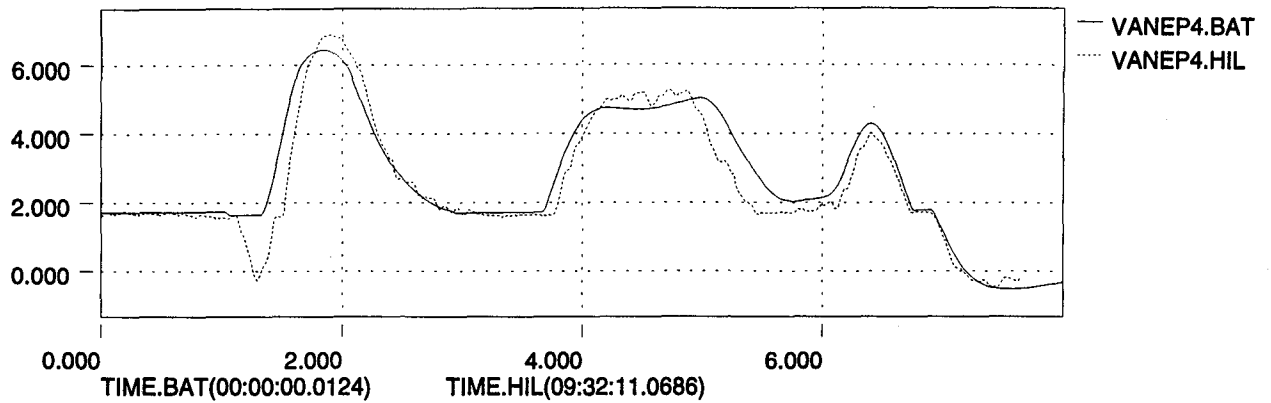
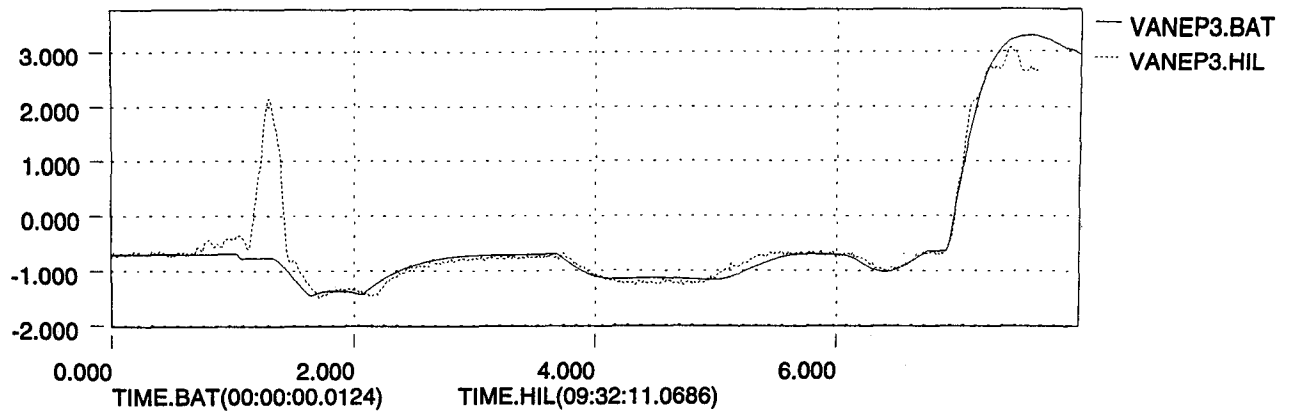


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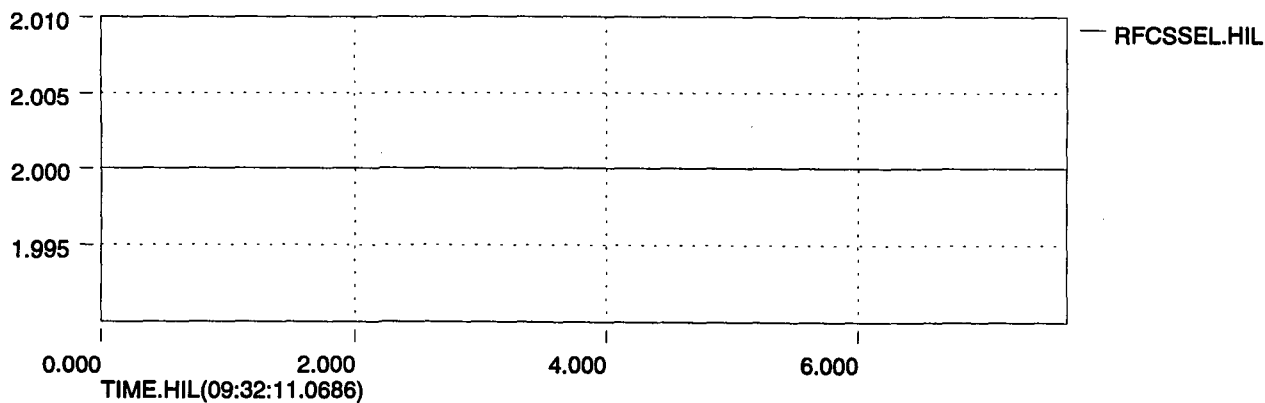
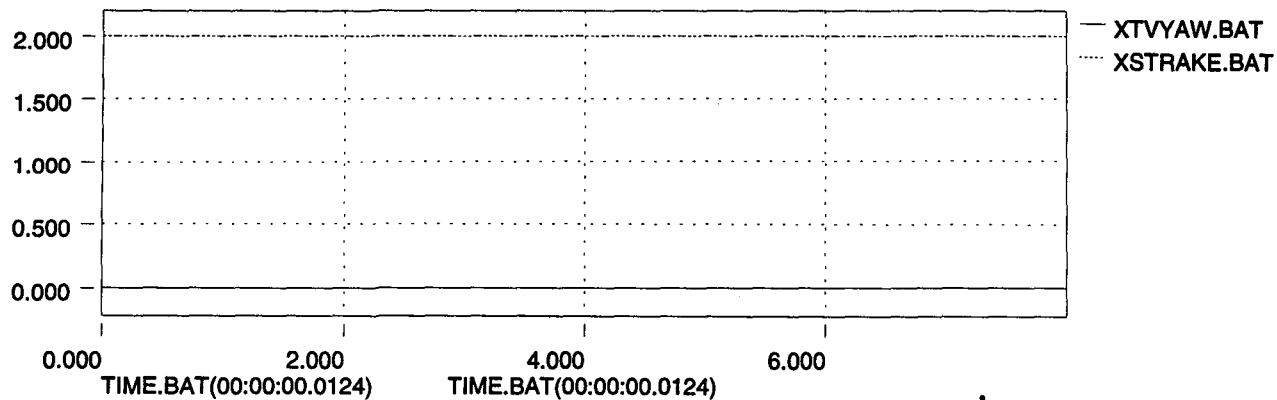
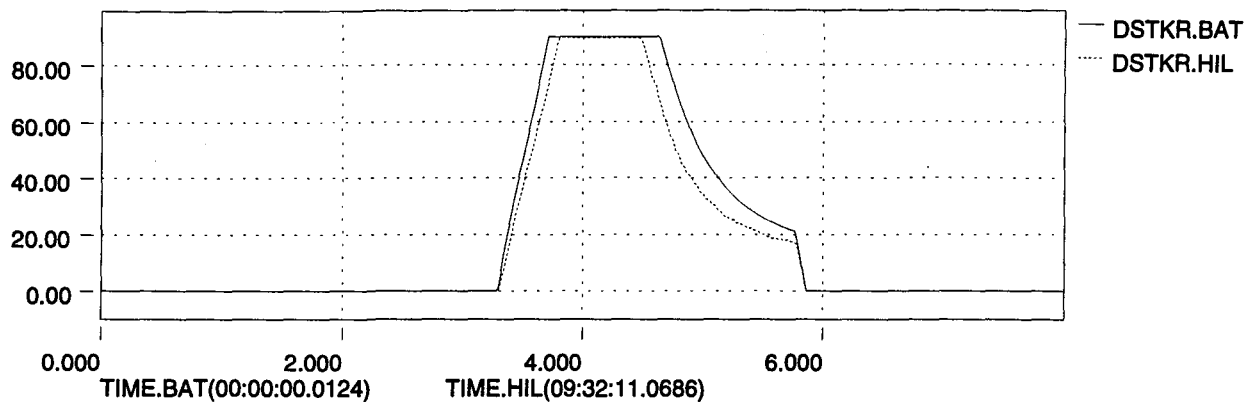
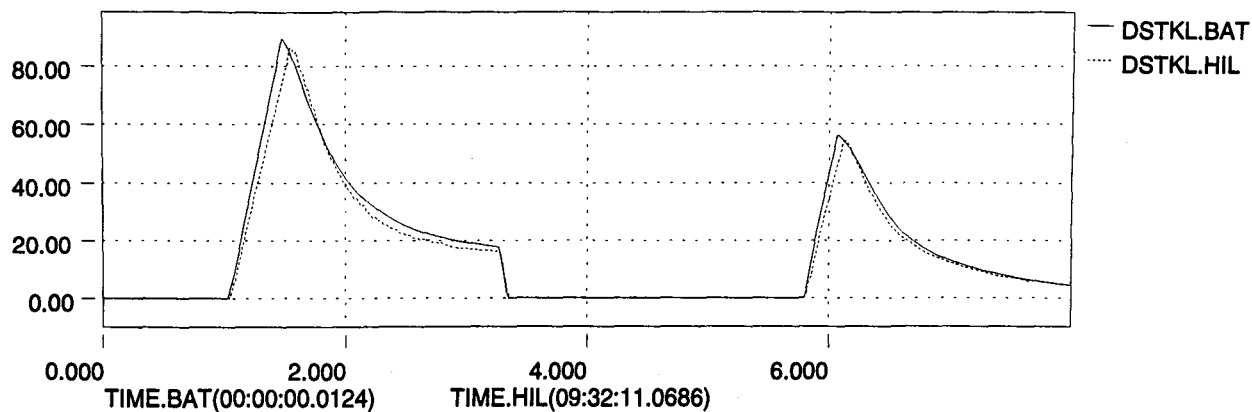
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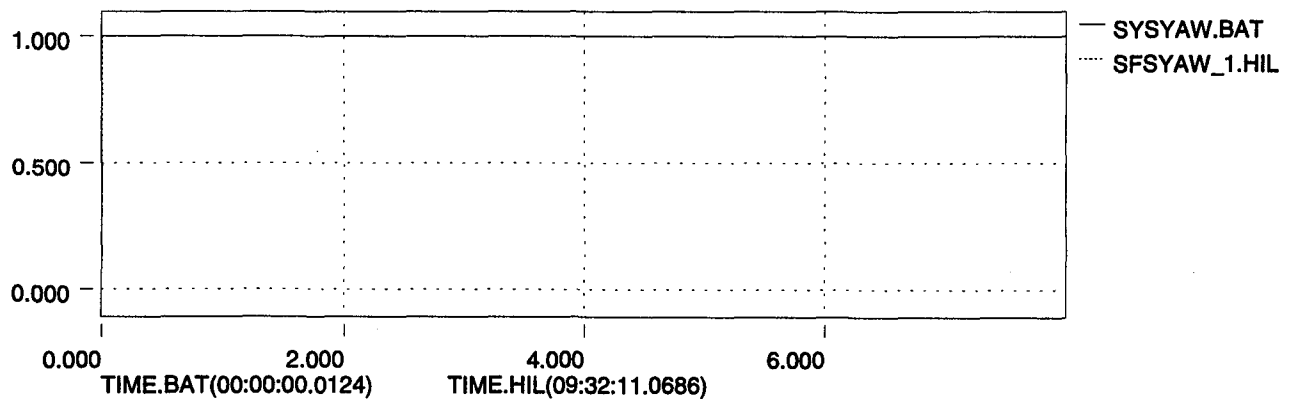
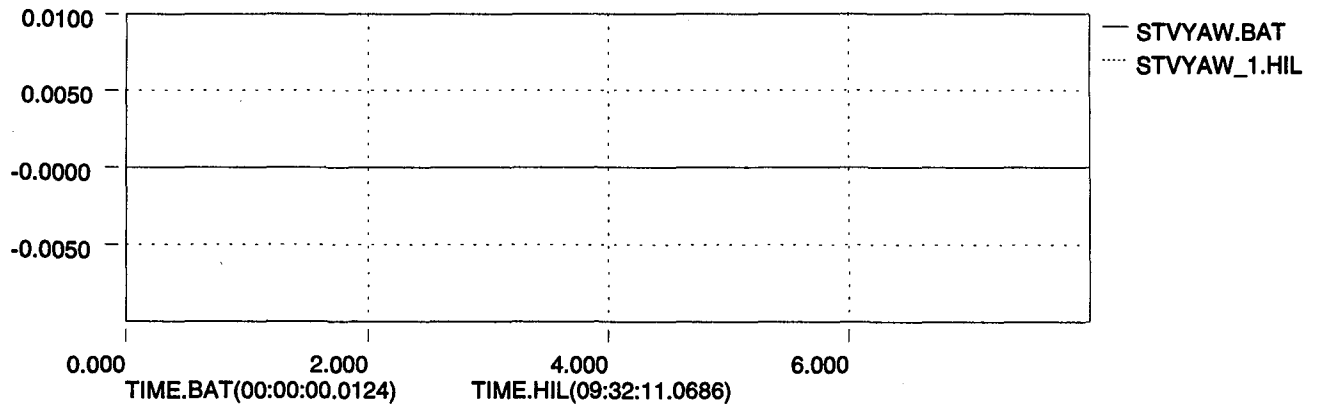
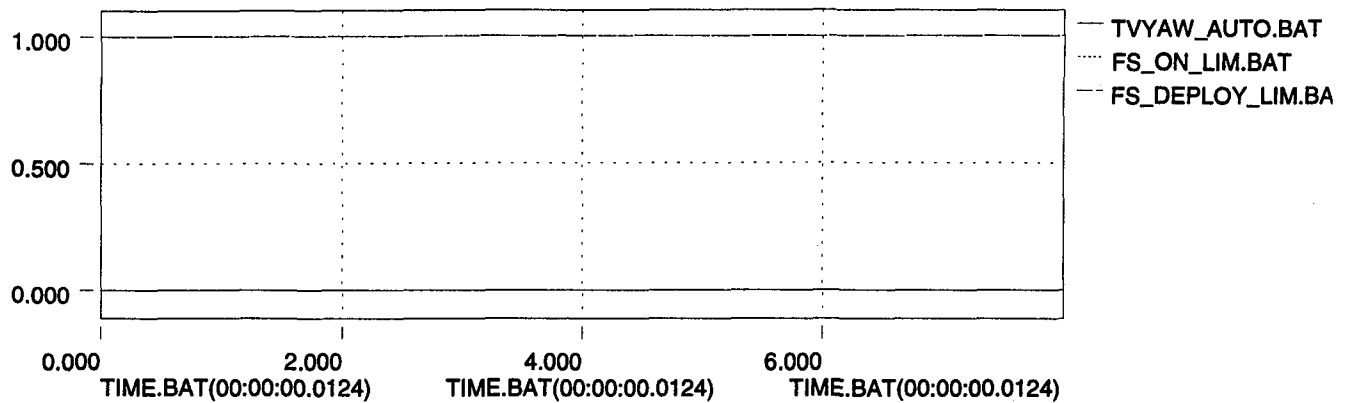
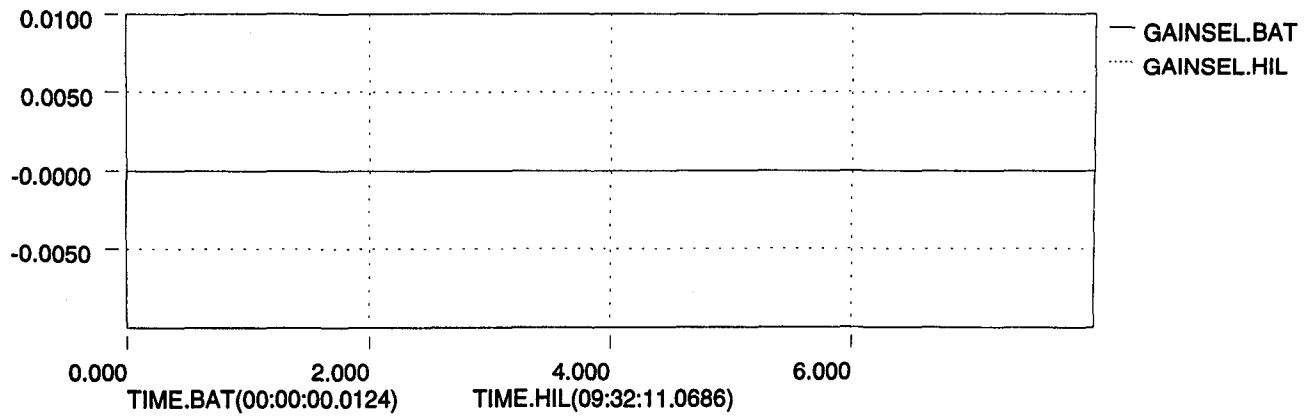
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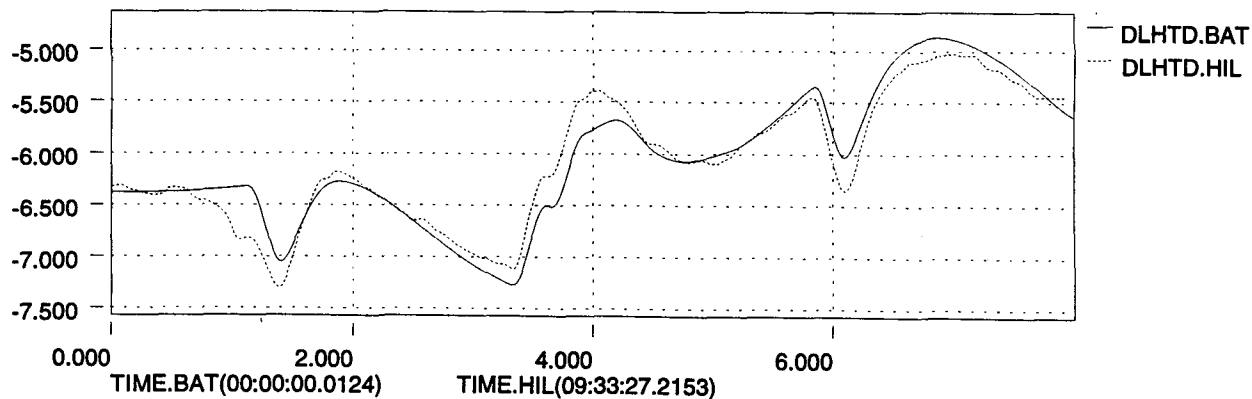
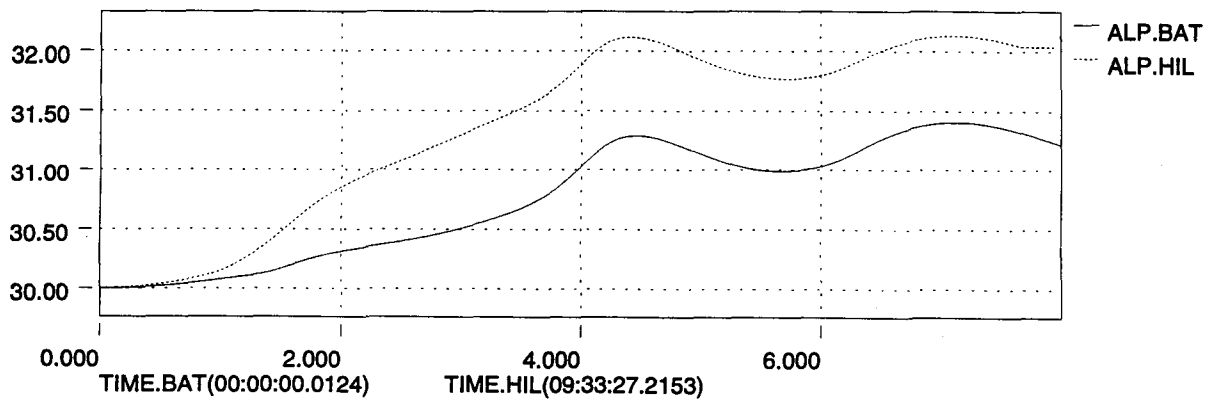
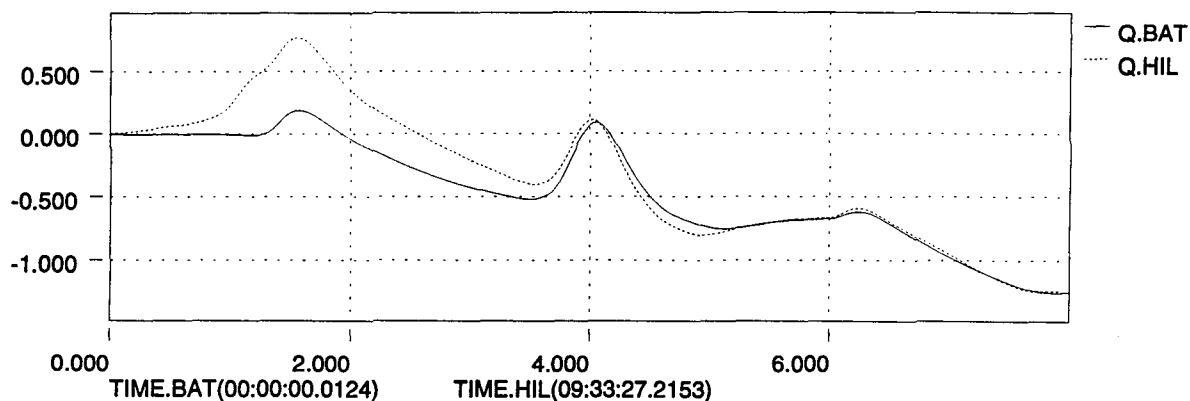
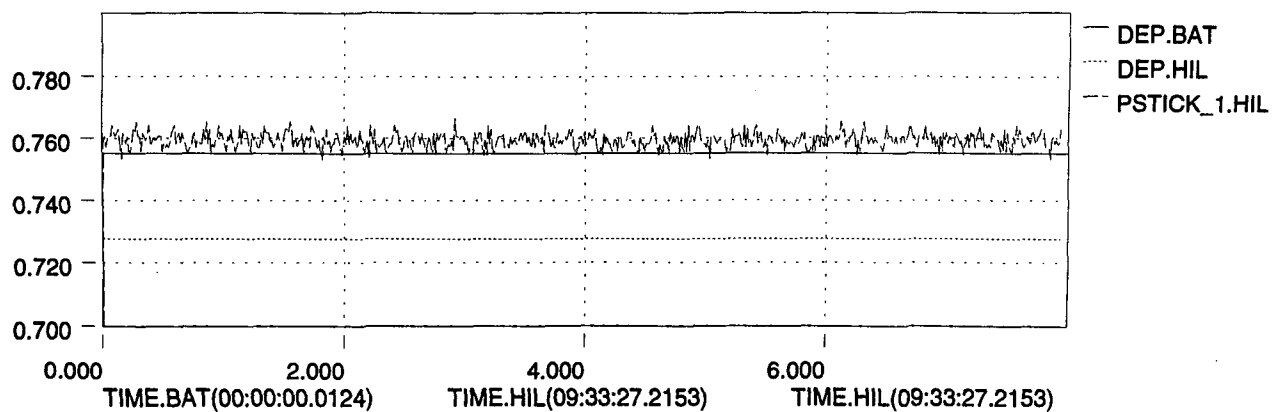
276





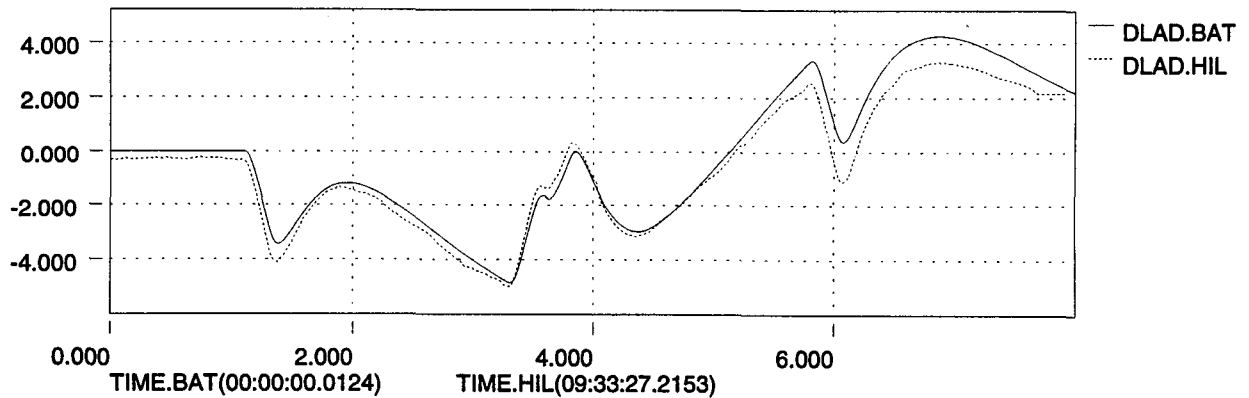
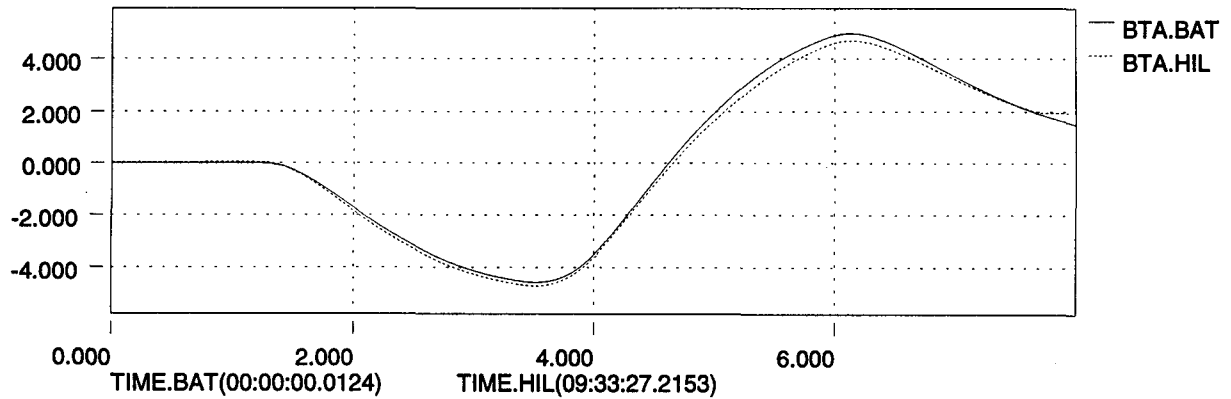
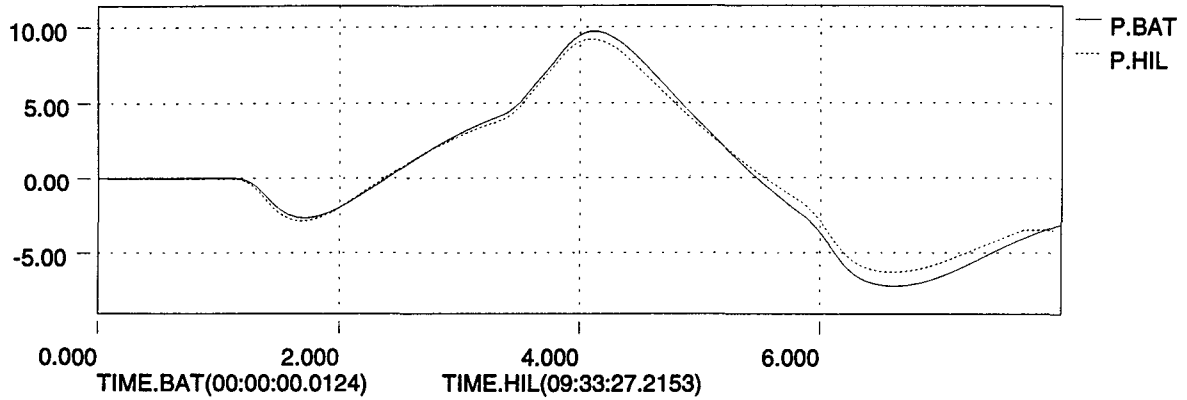
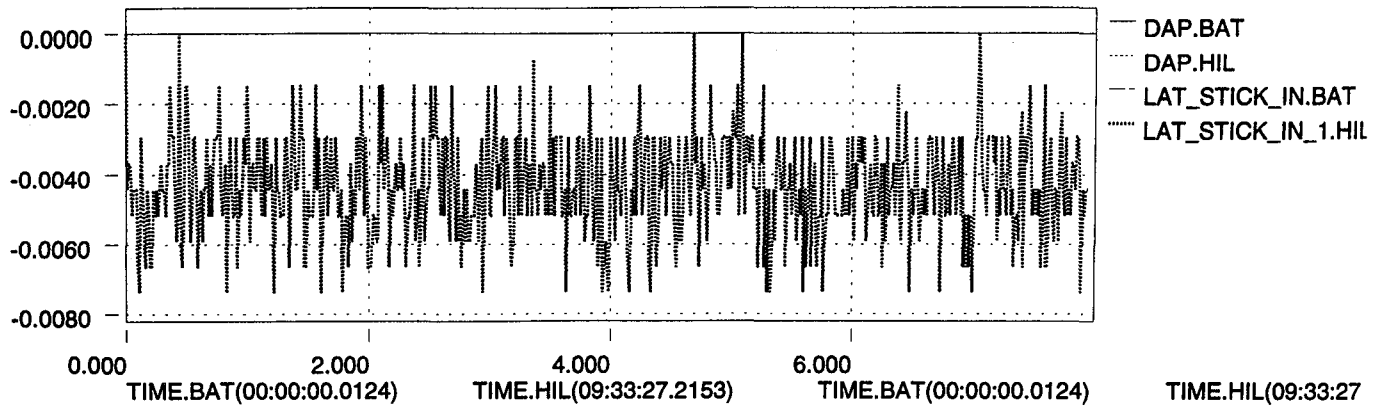
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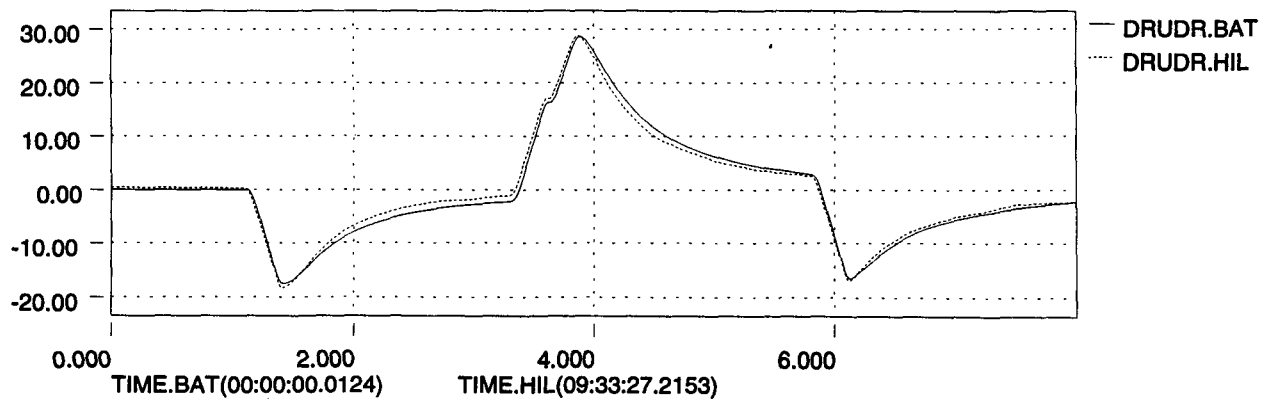
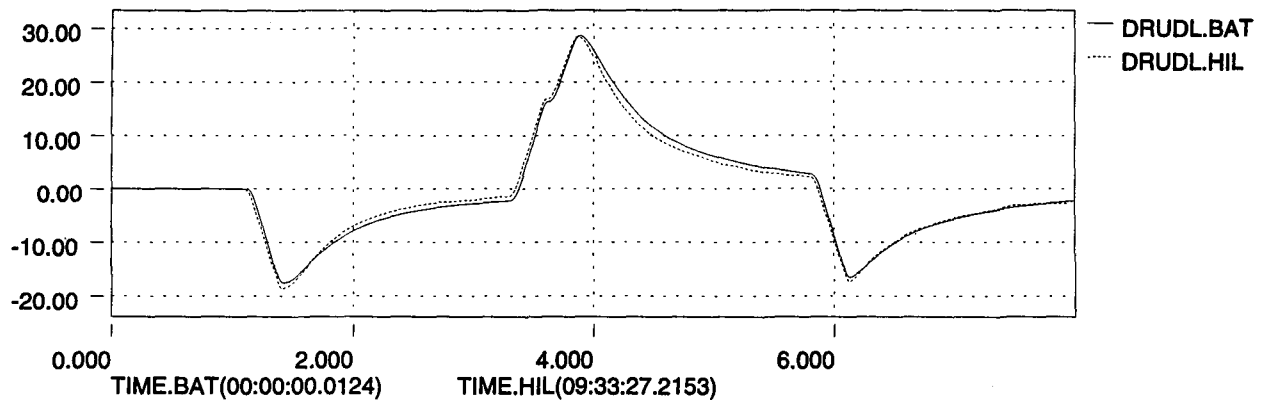
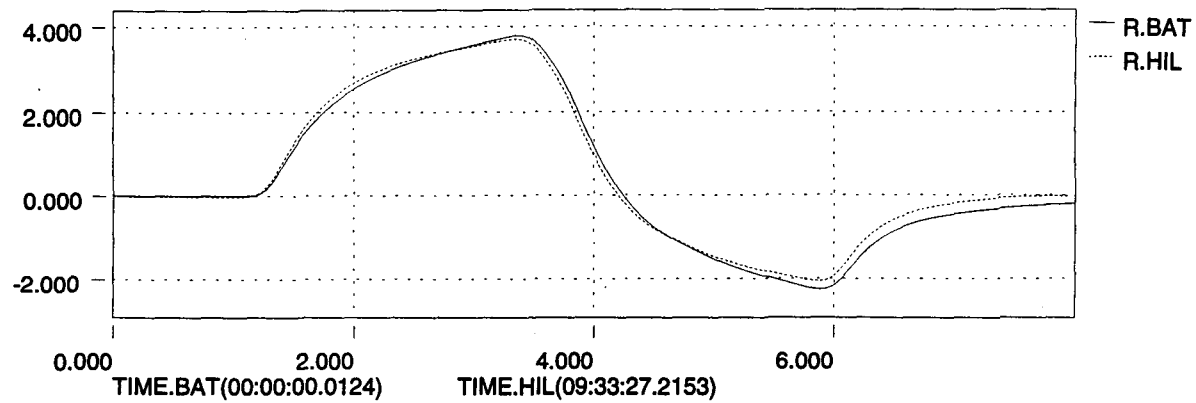
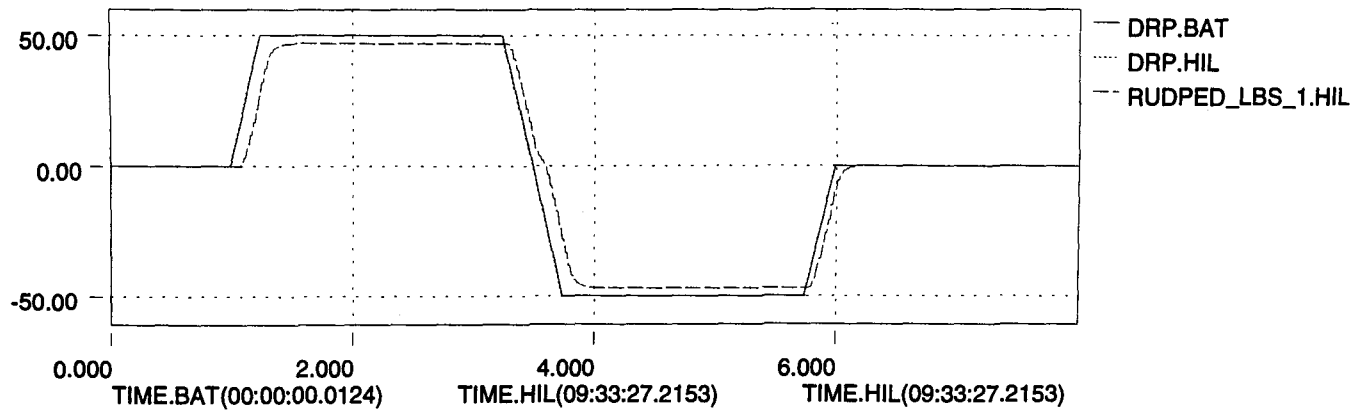


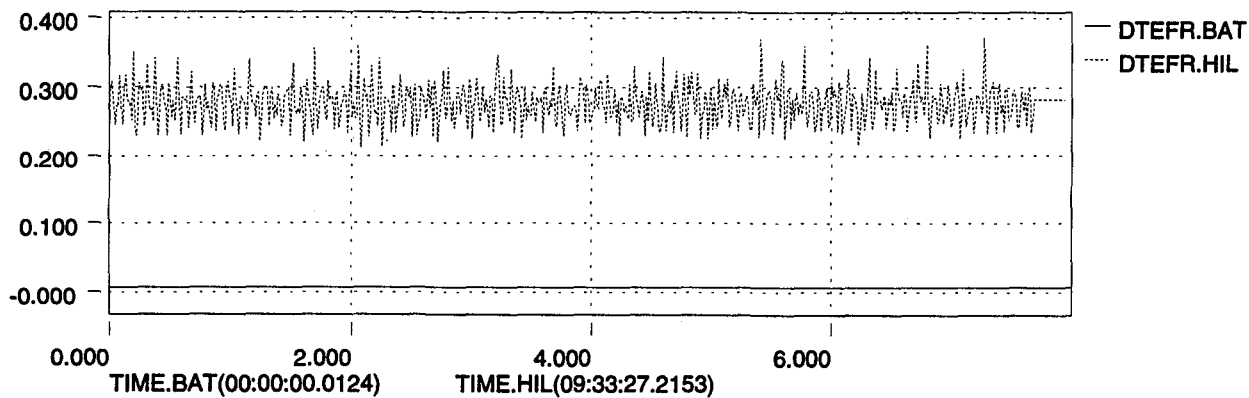
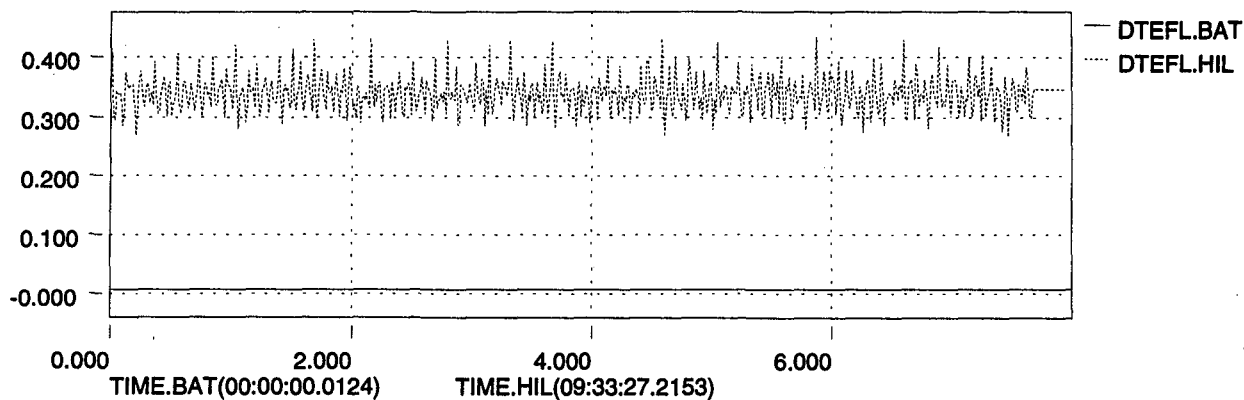
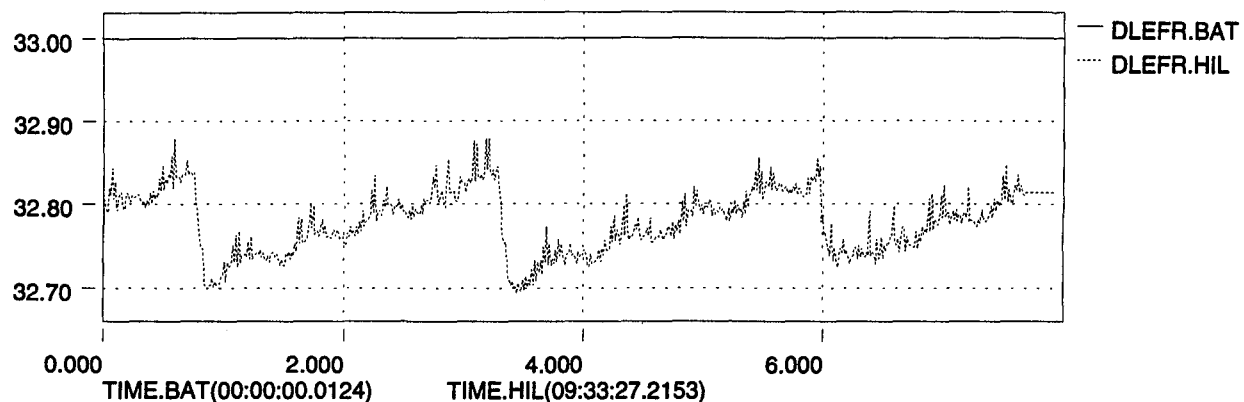
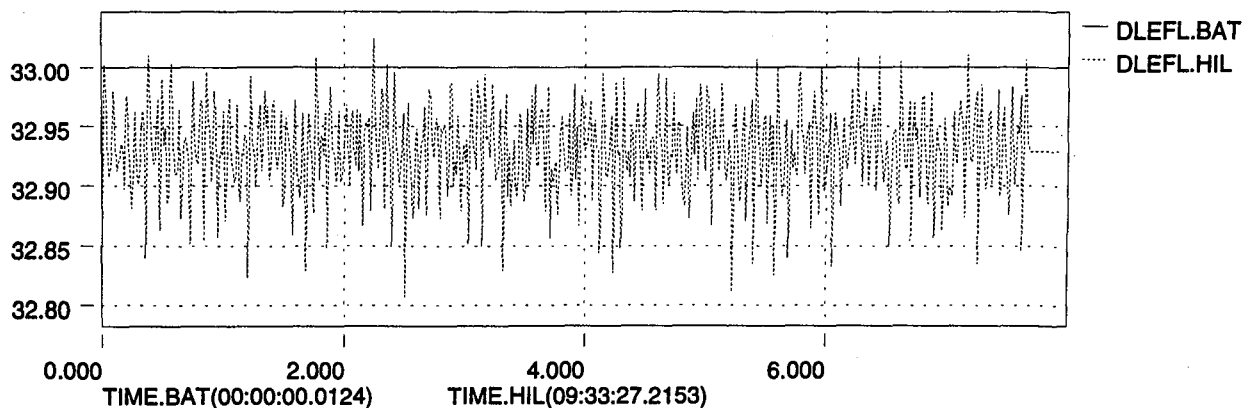
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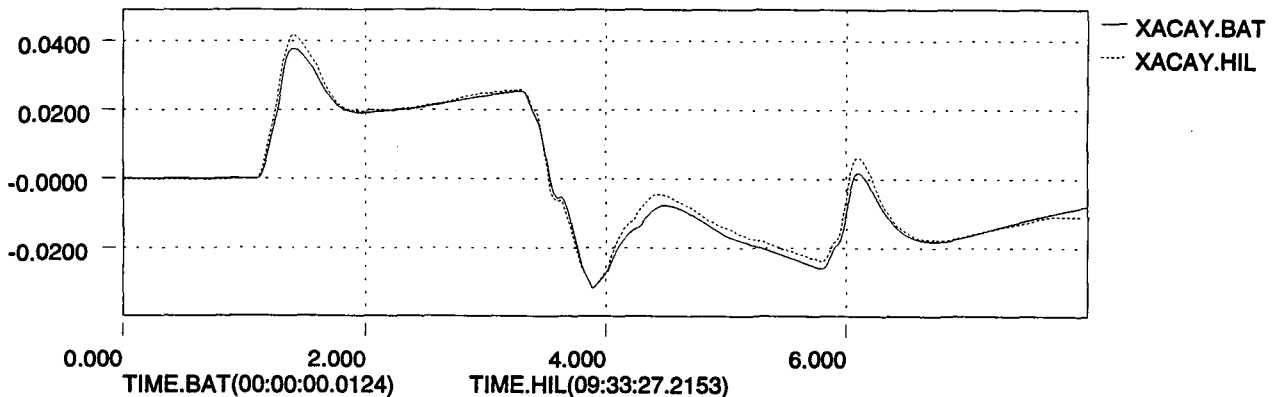
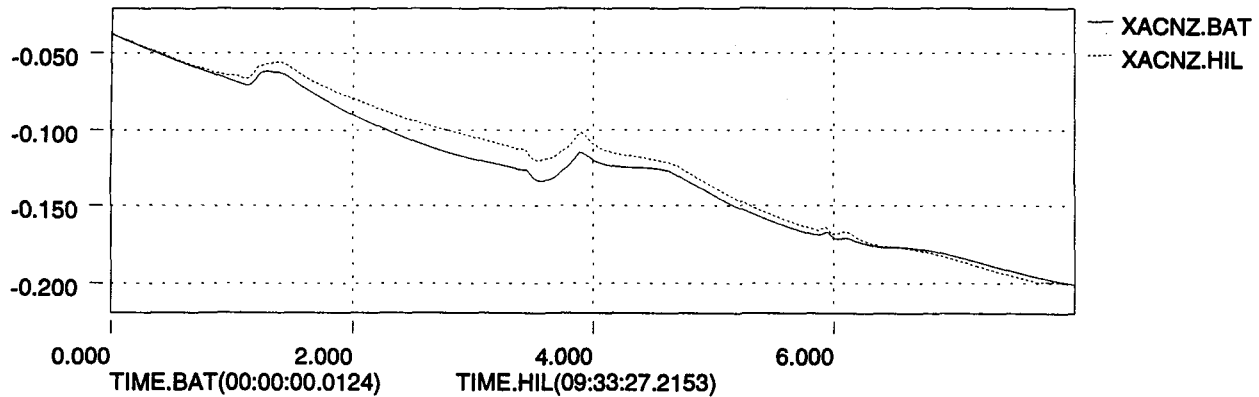
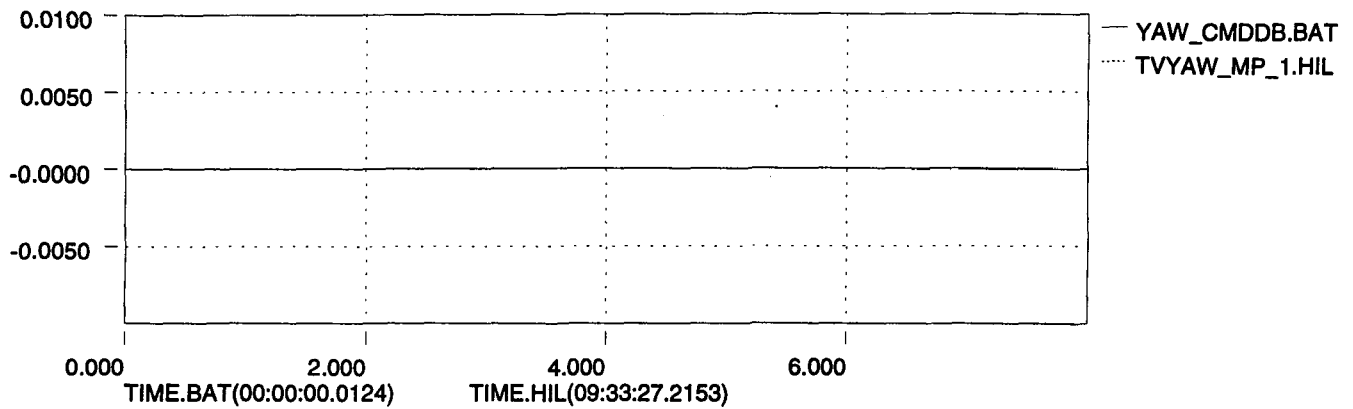
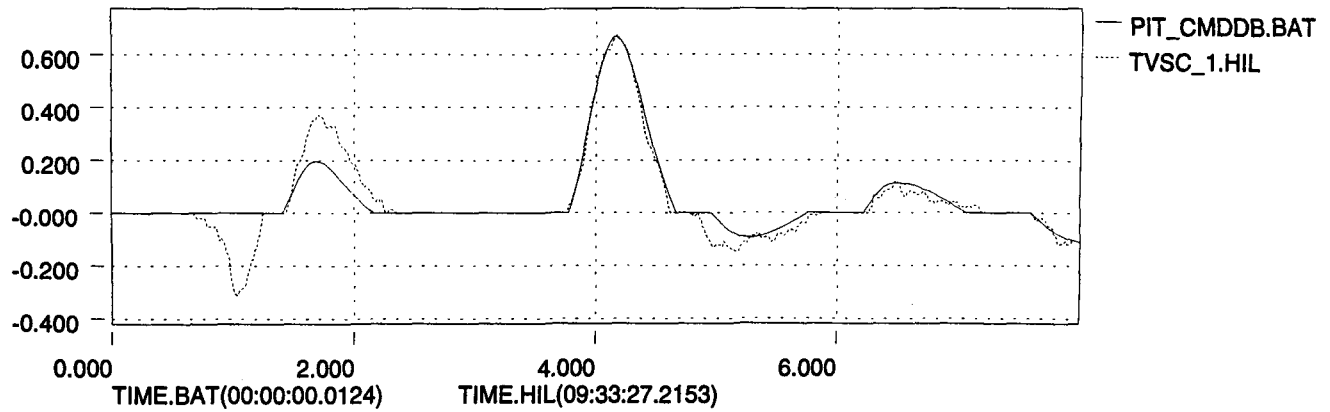
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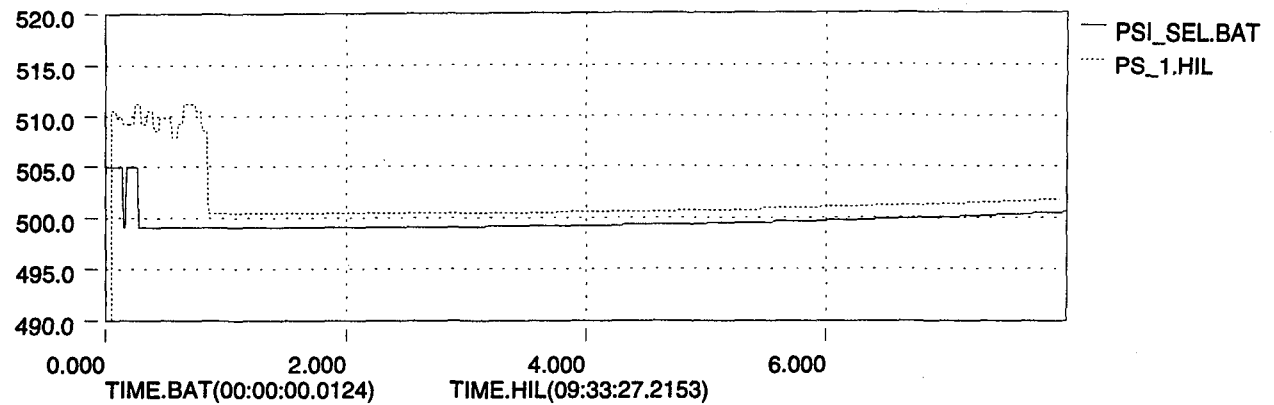
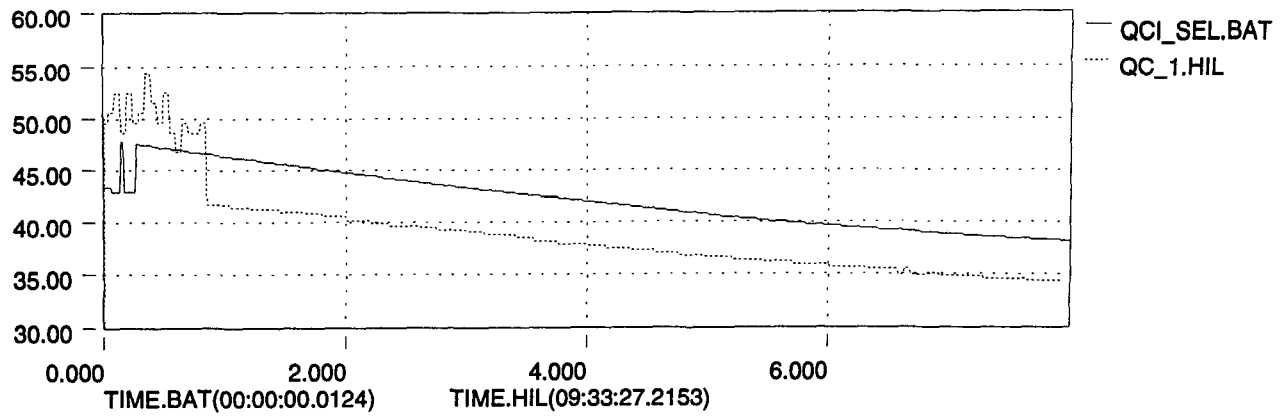
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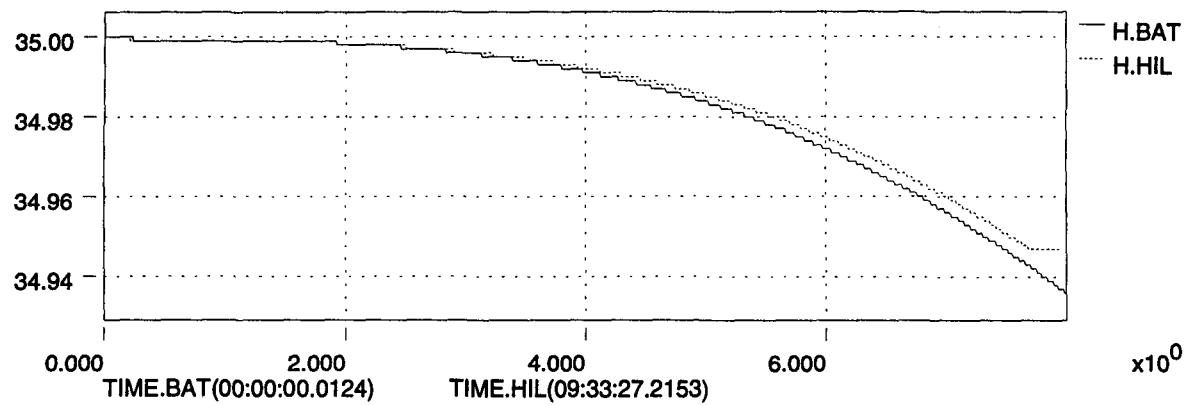


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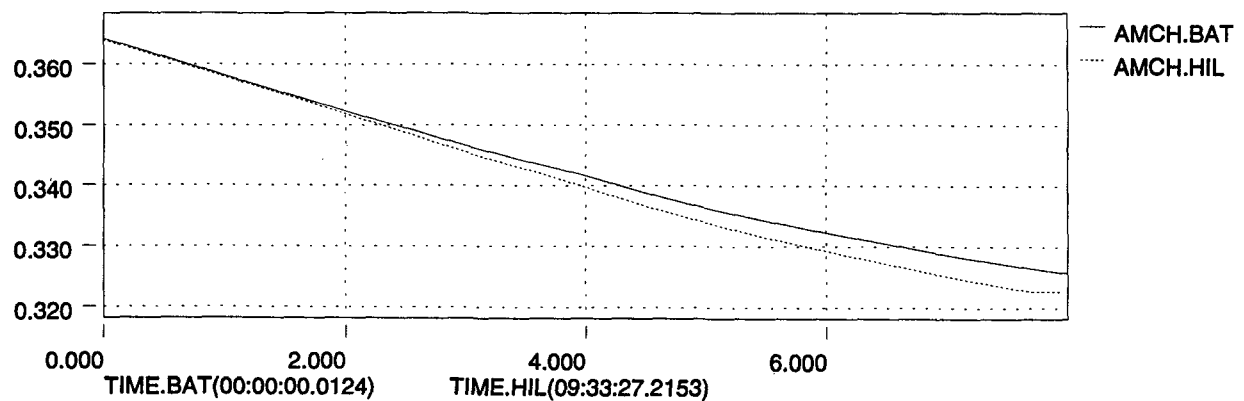
283



$\times 10^3$

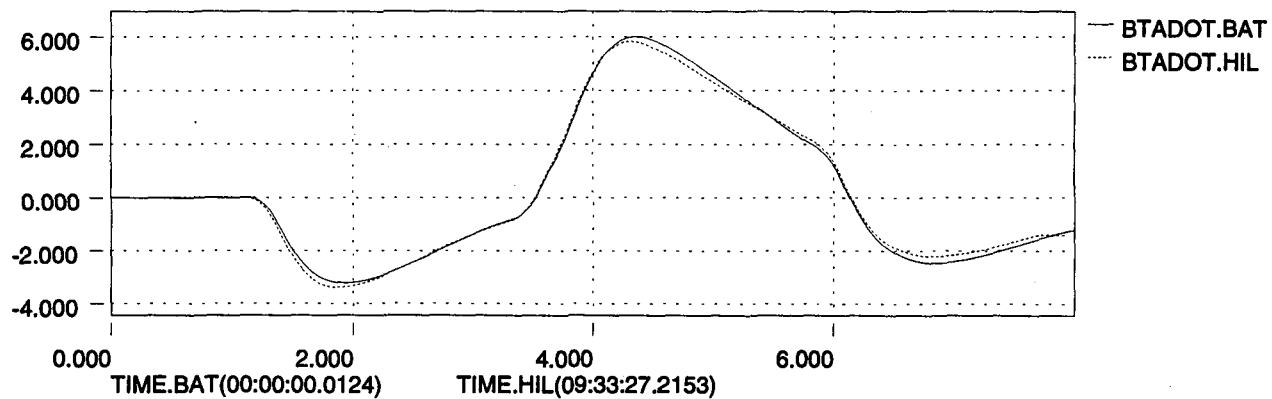
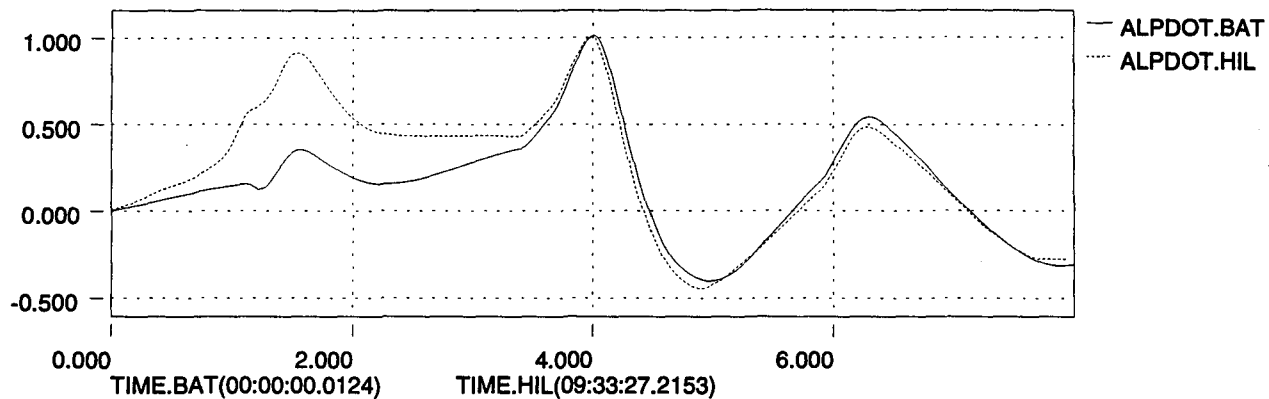
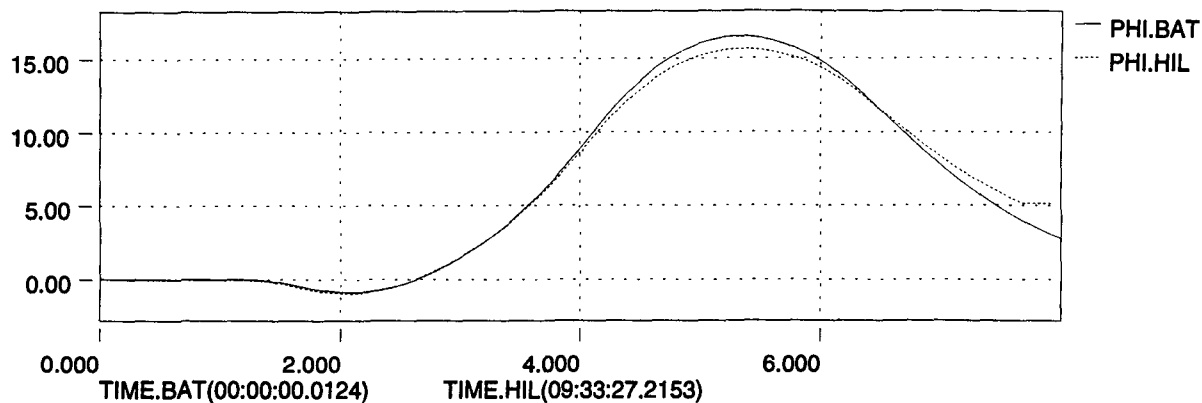
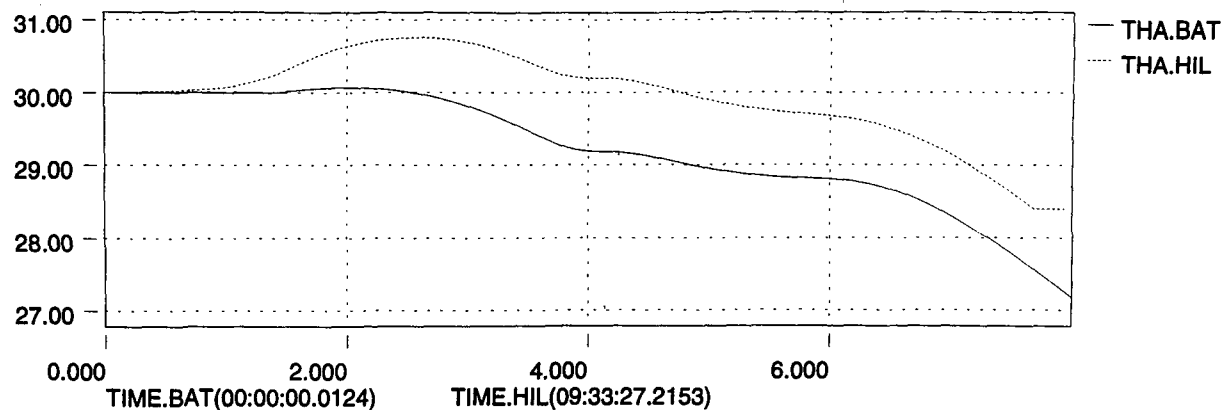


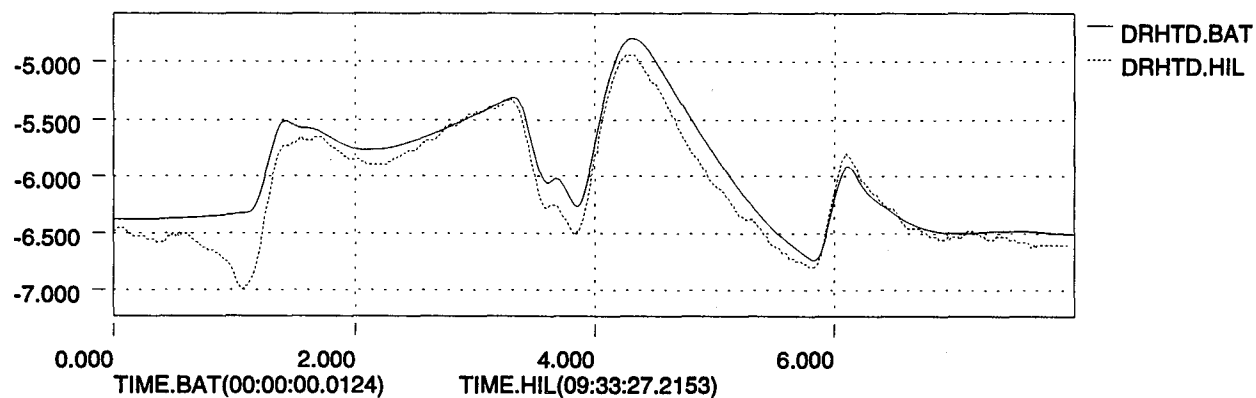
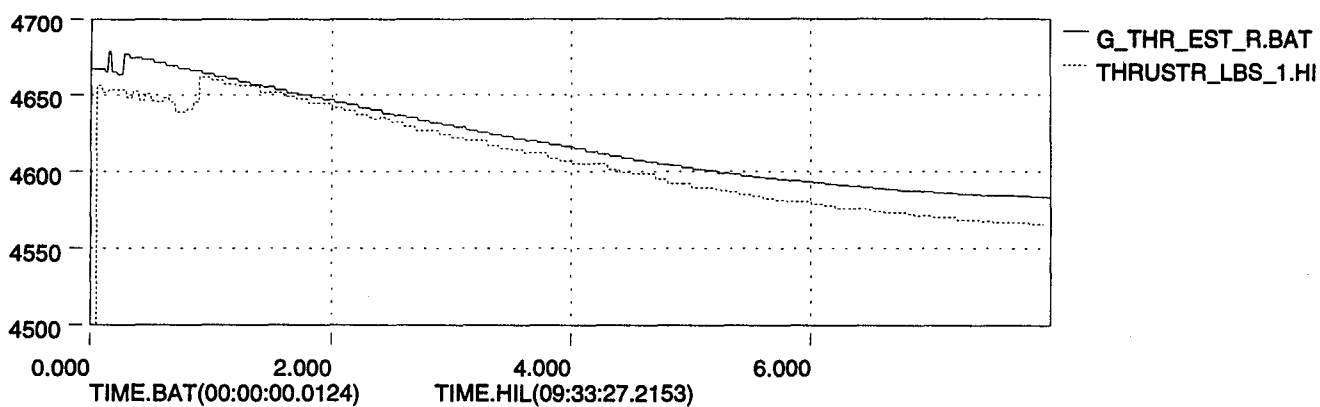
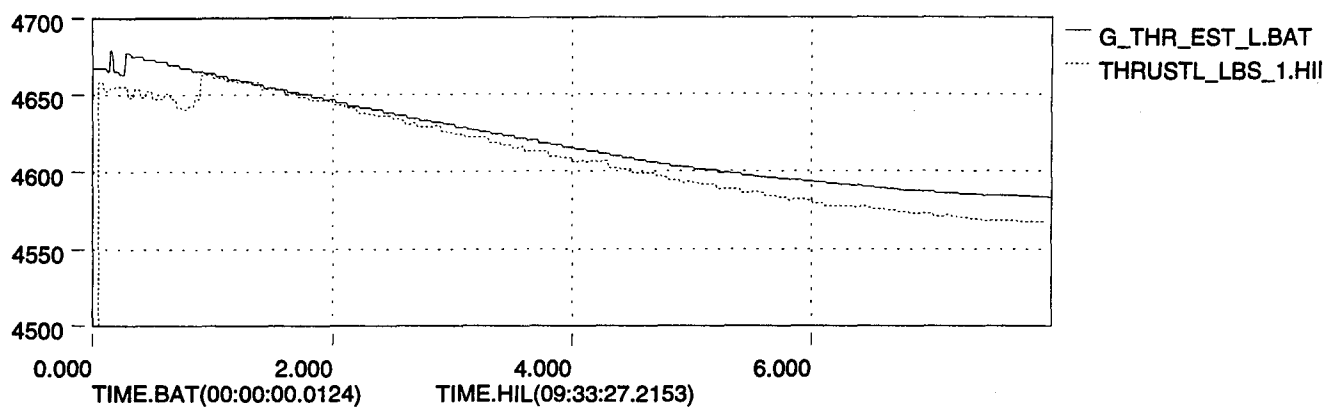
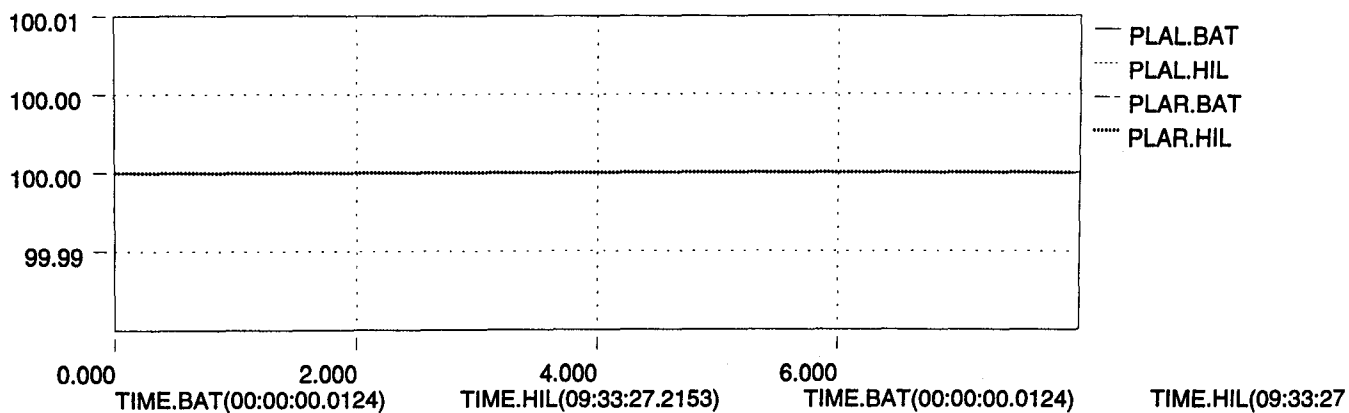
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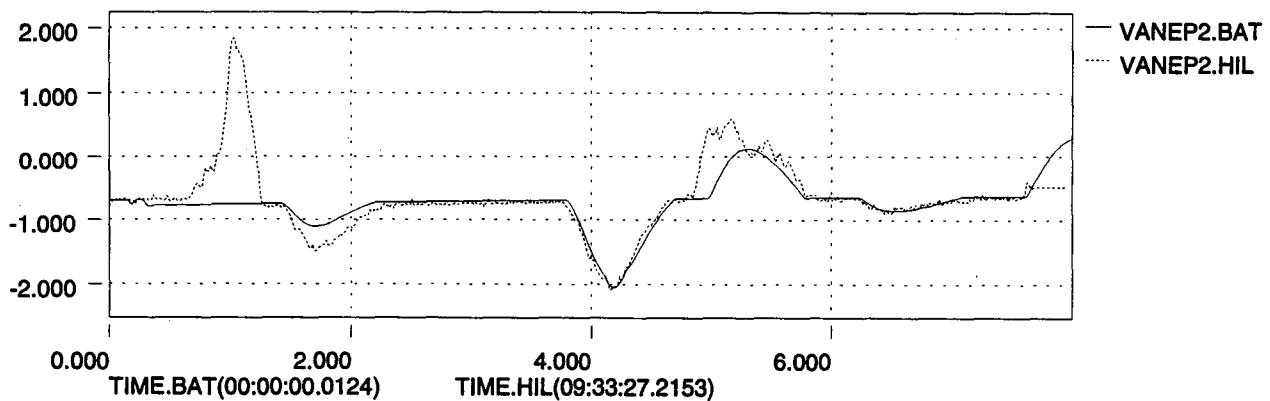
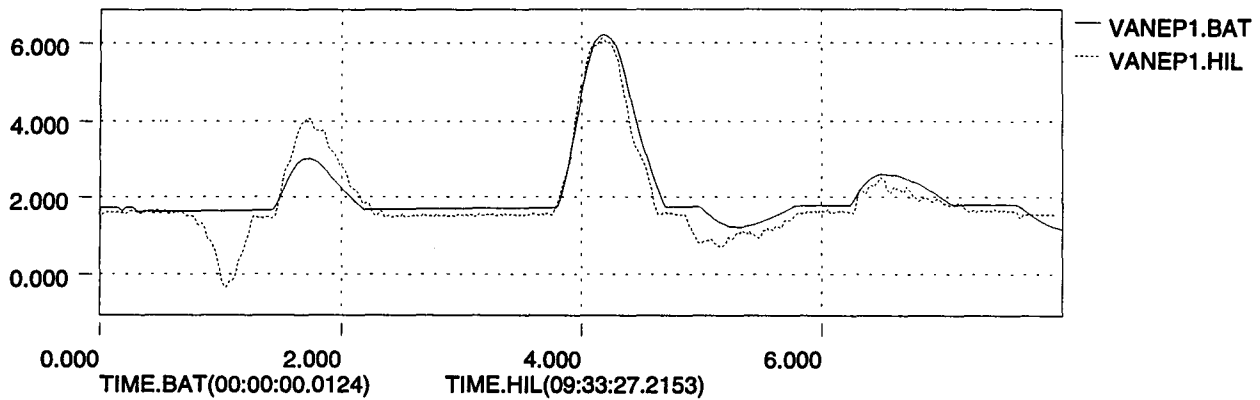
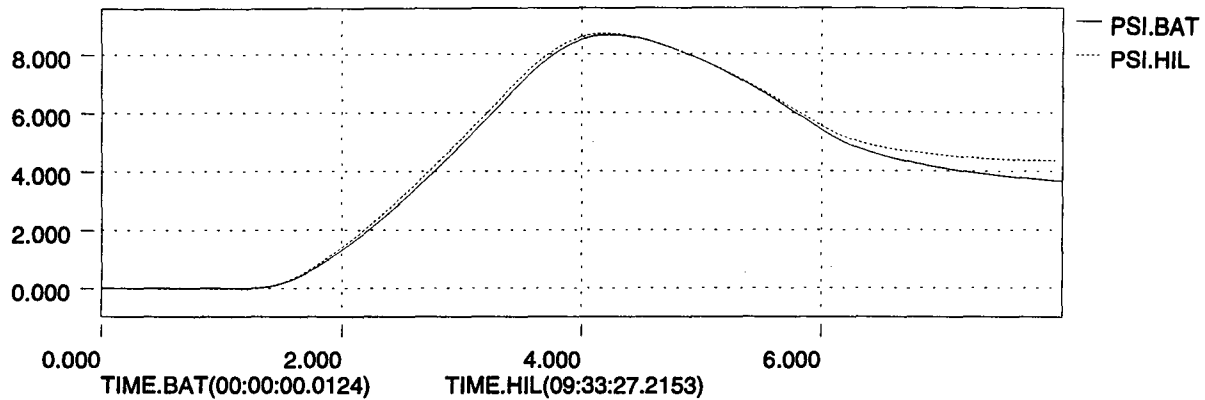
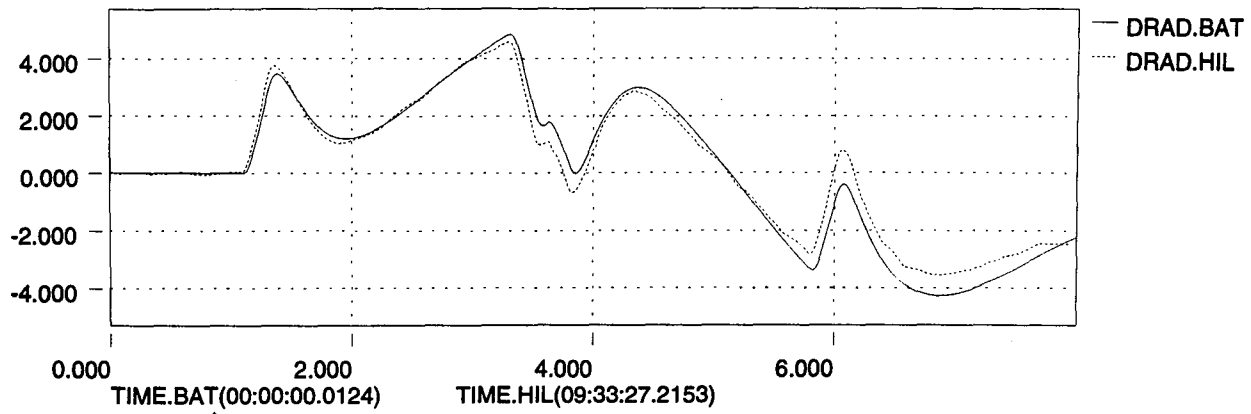
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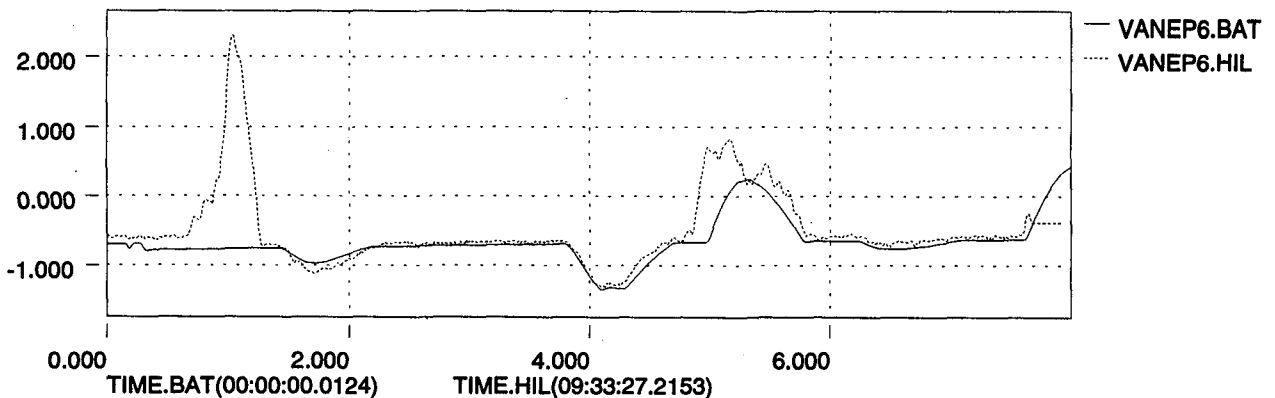
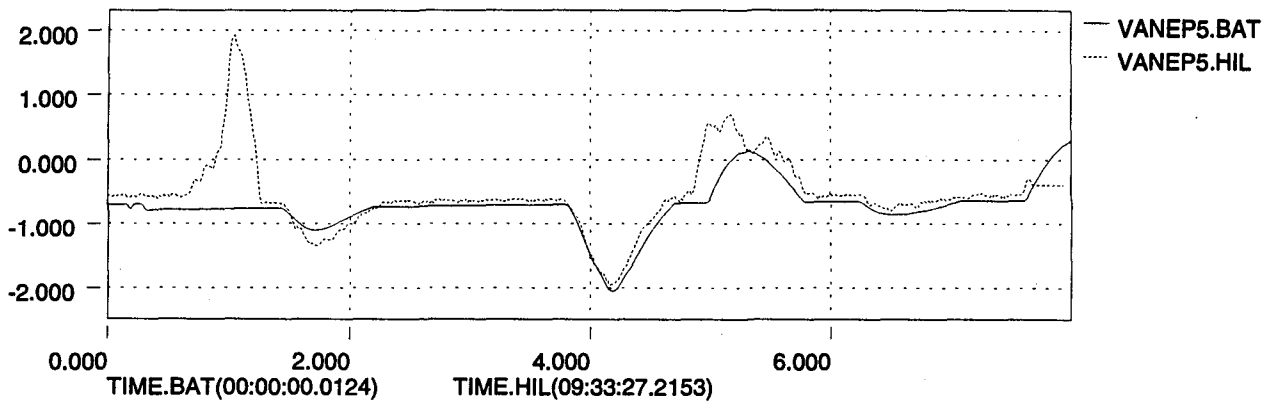
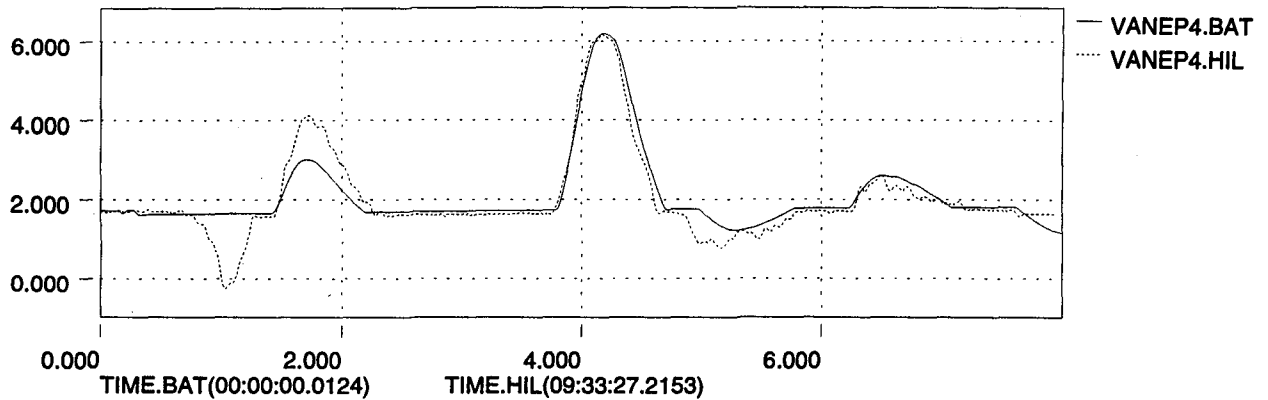
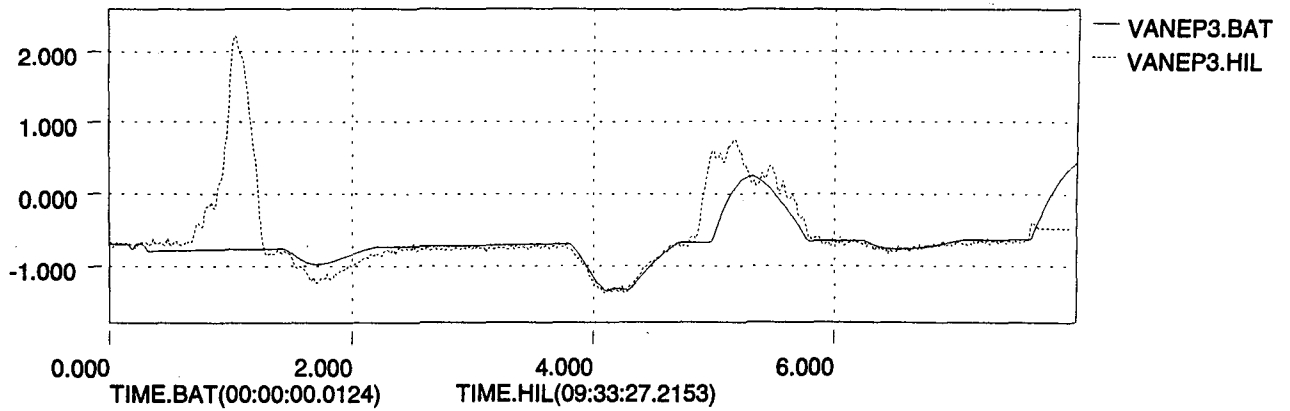




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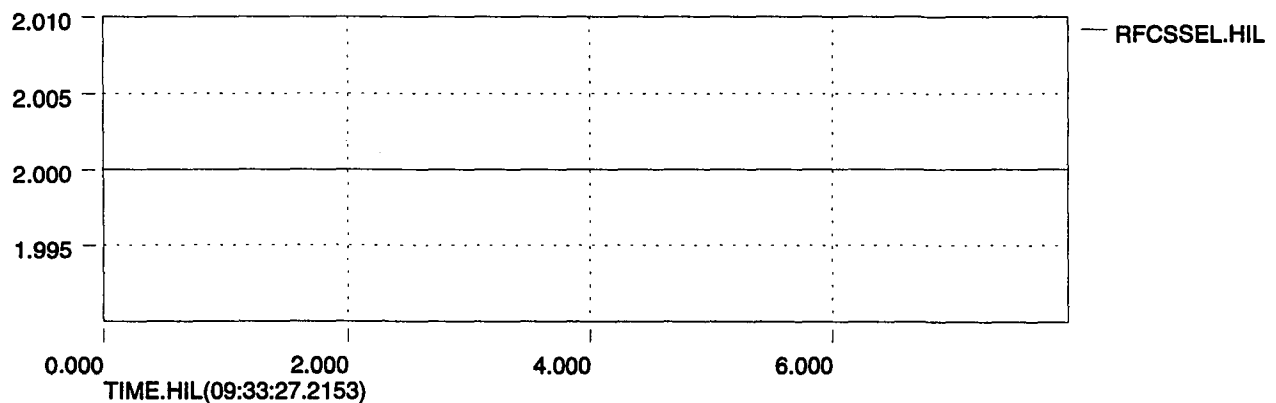
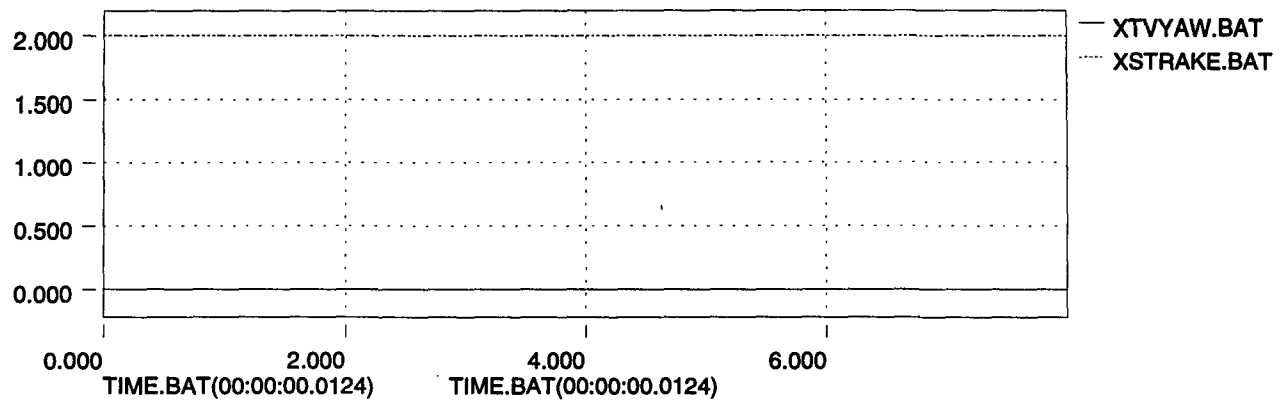
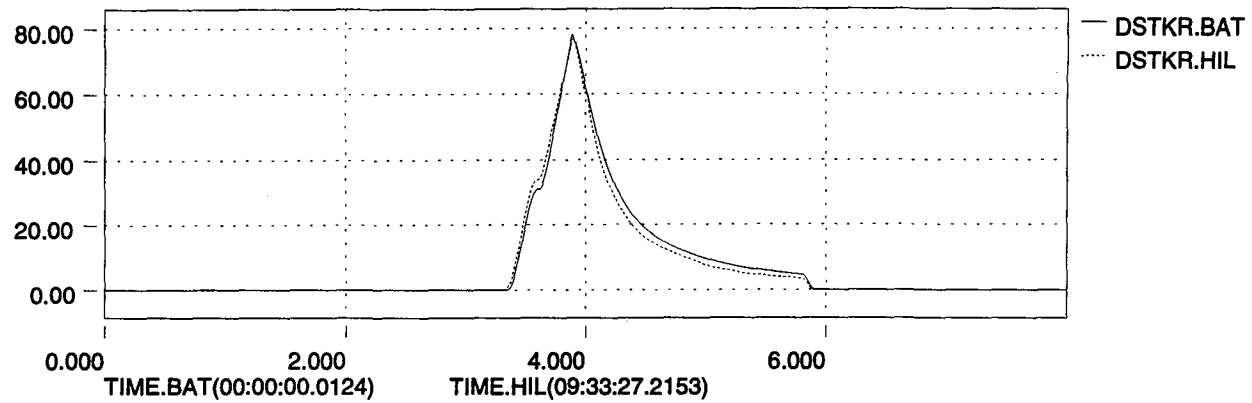
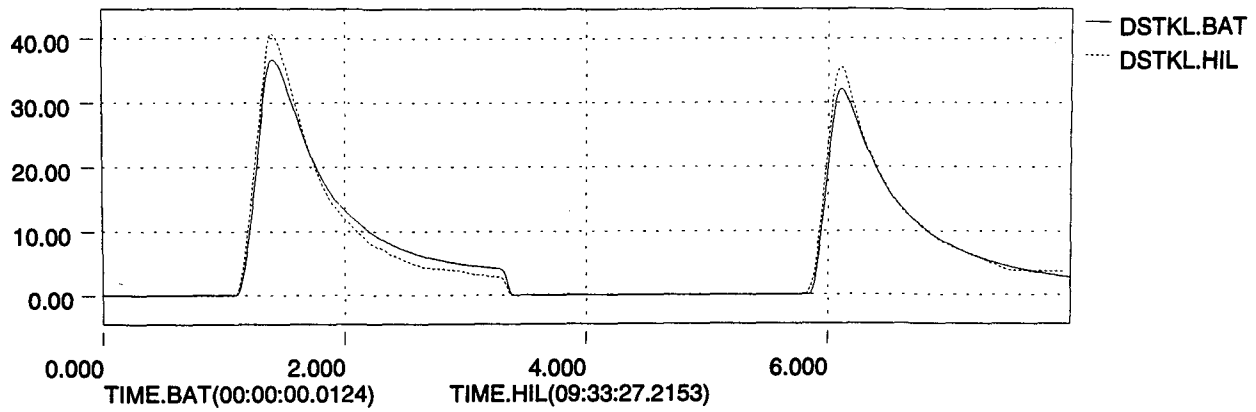
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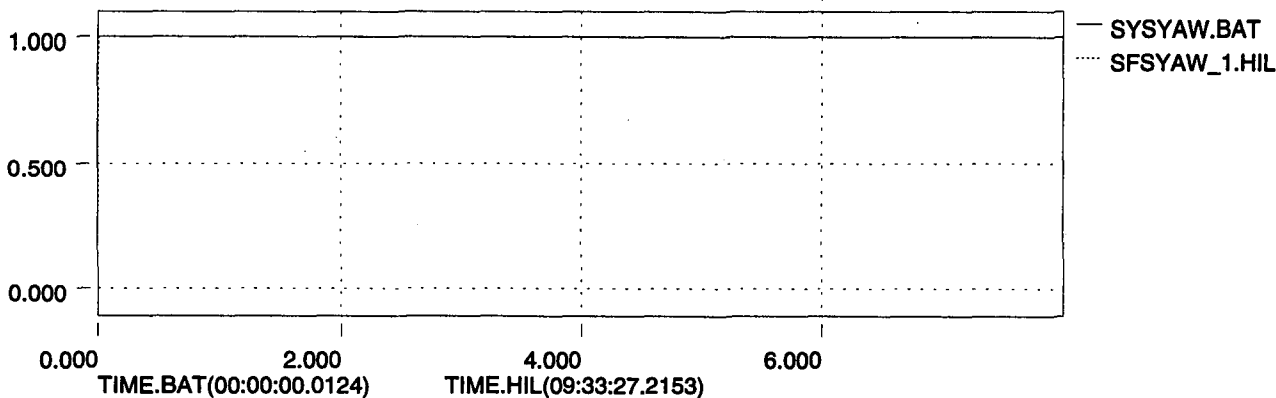
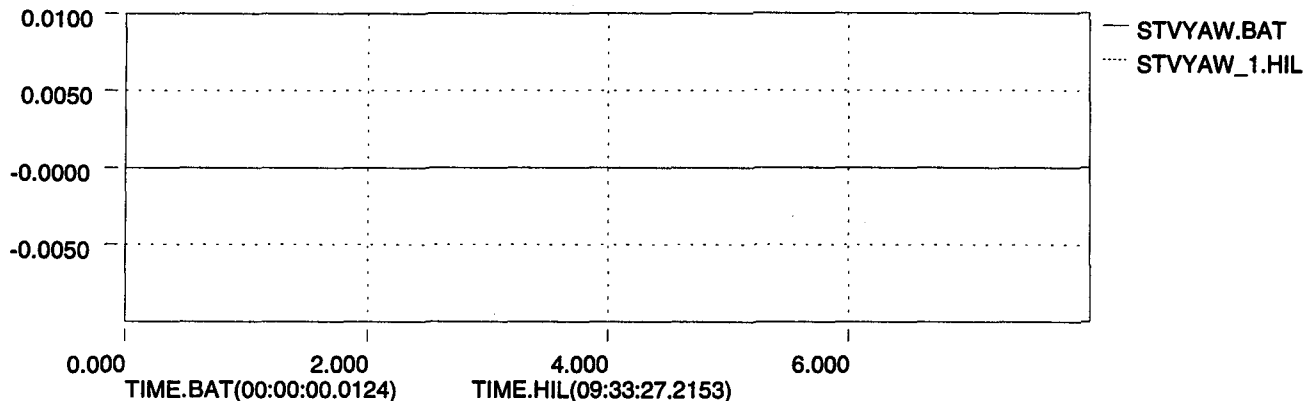
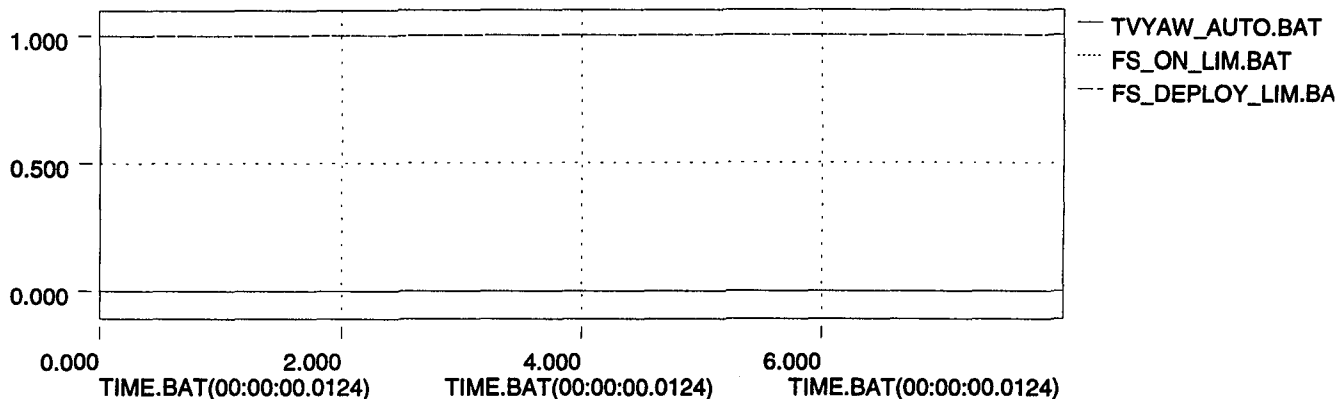
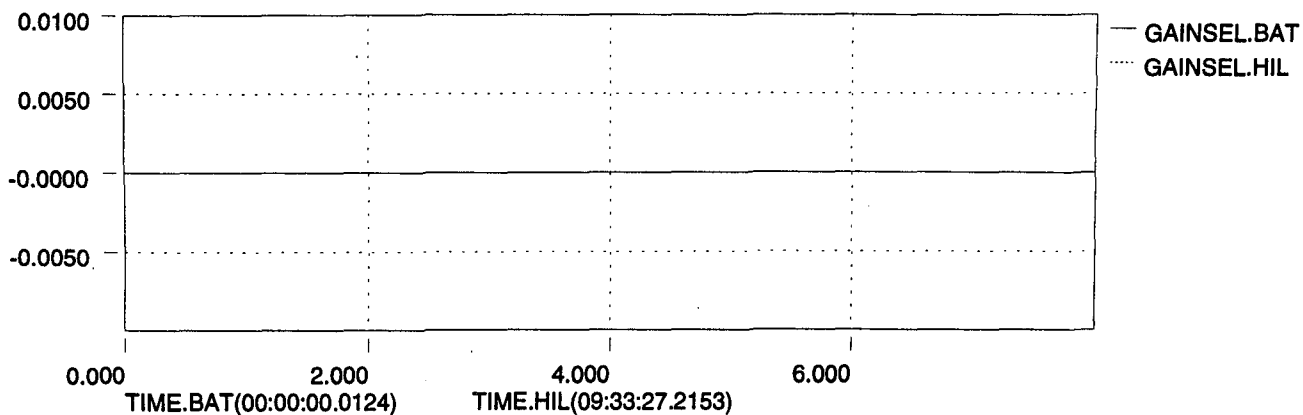




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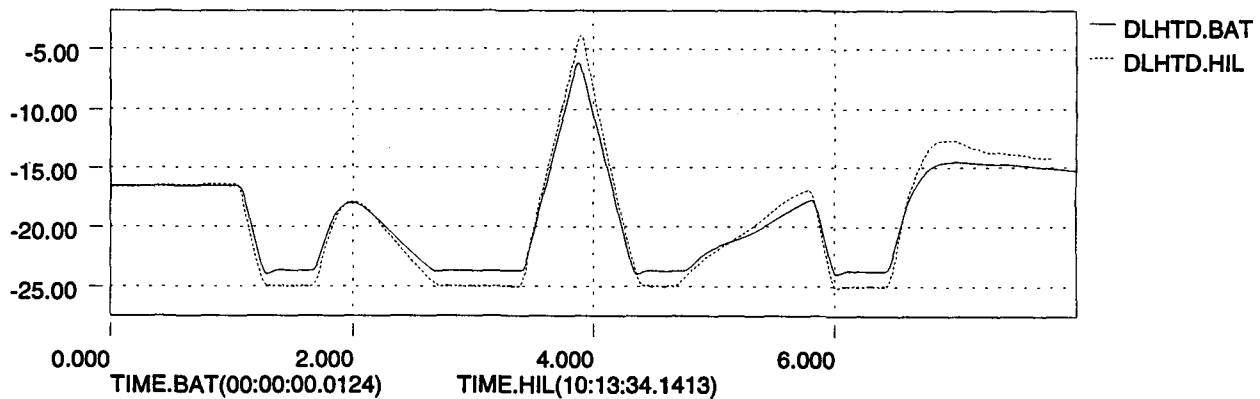
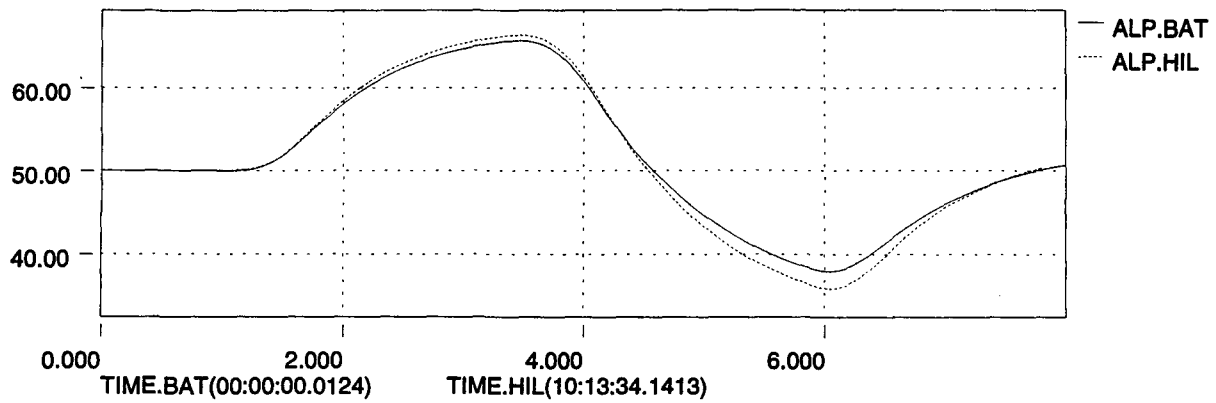
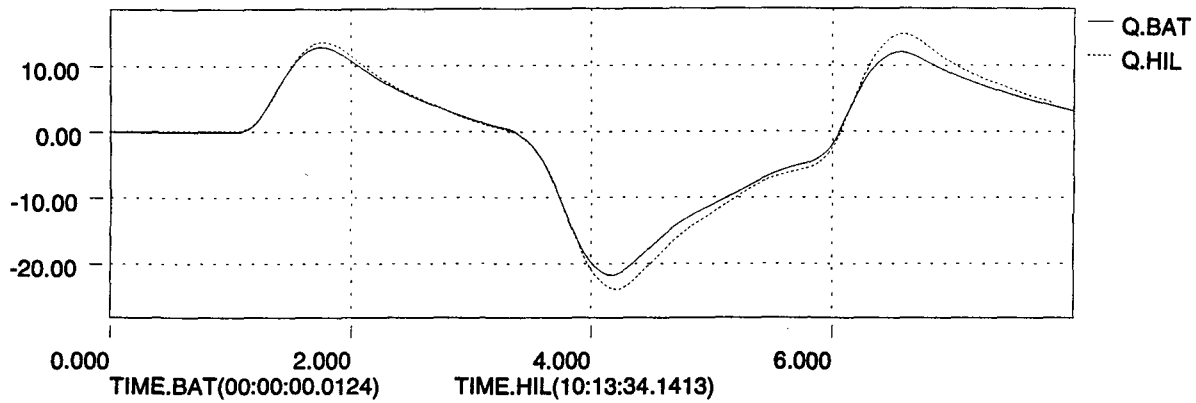
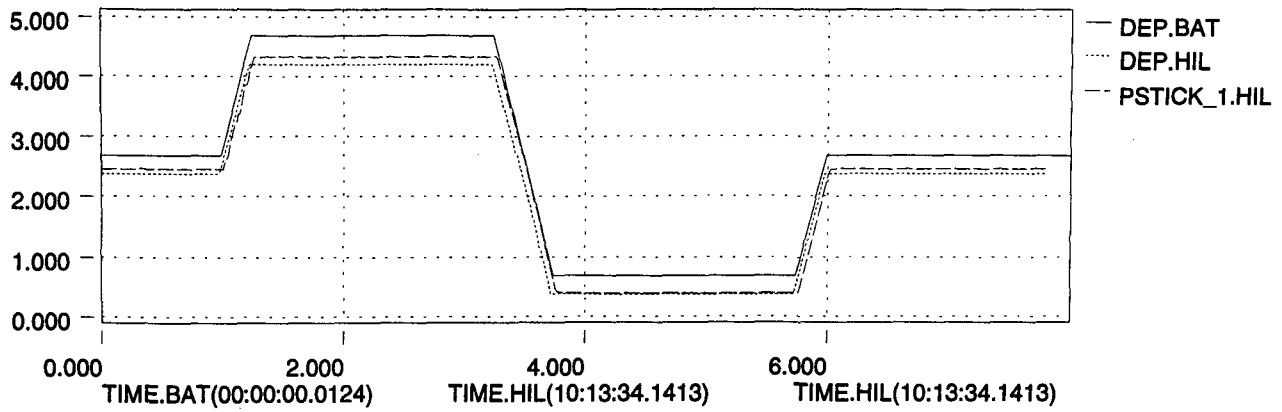
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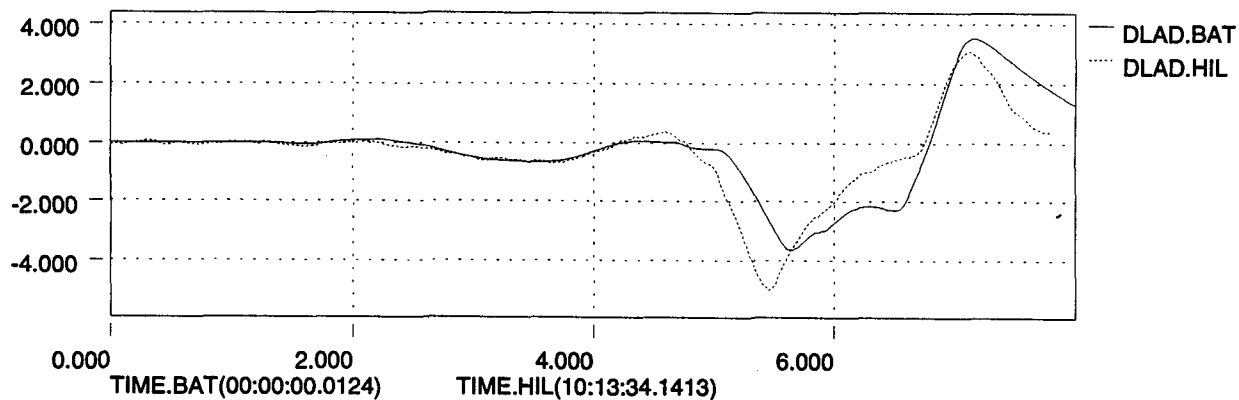
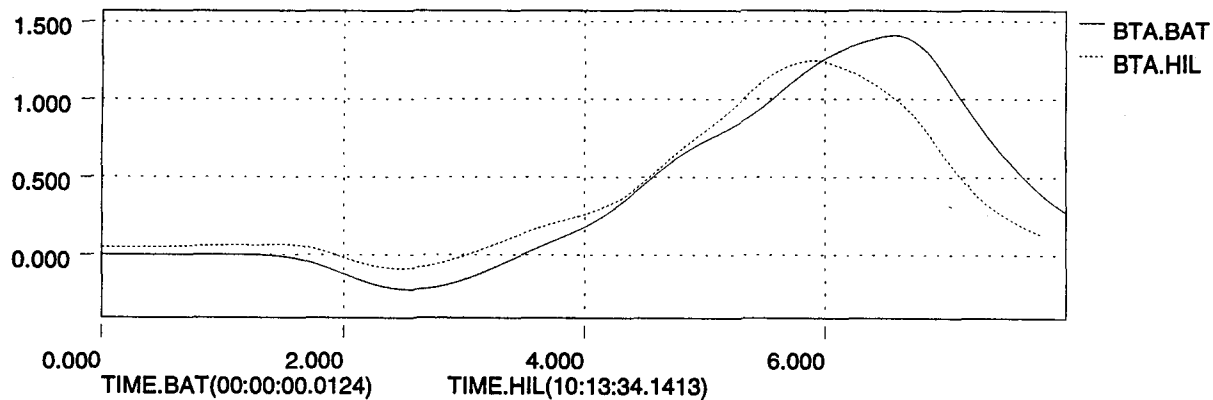
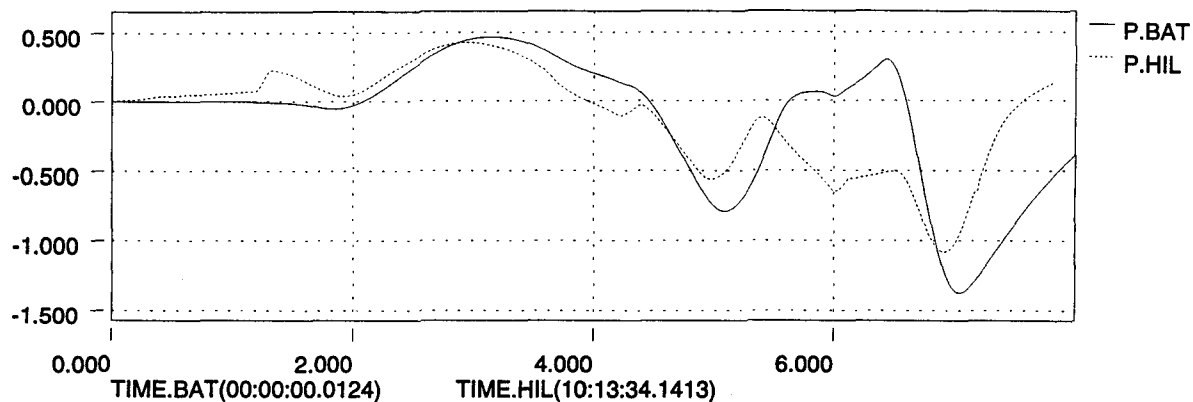
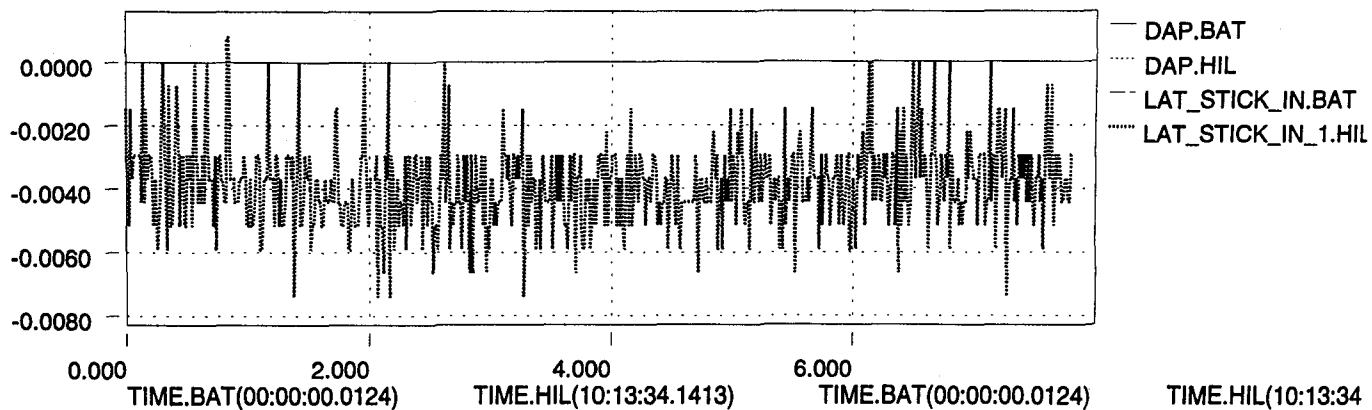




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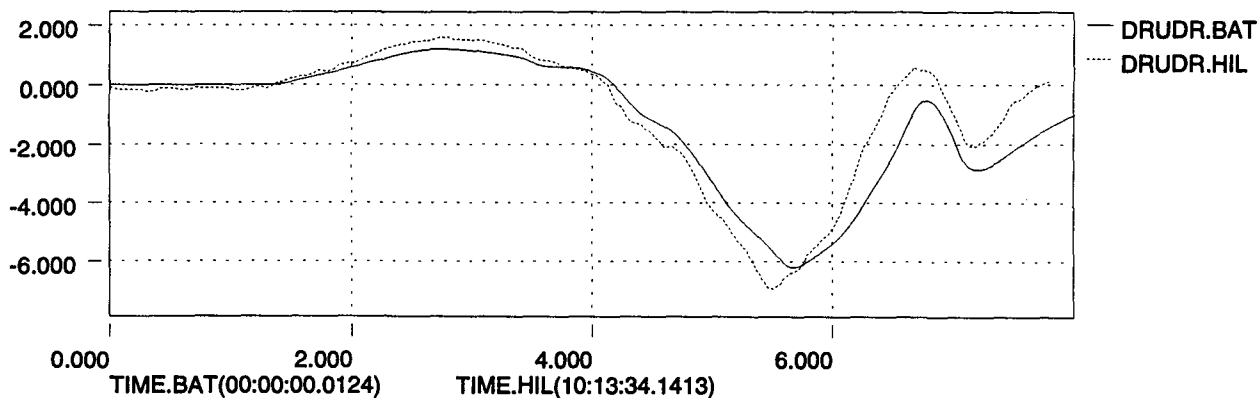
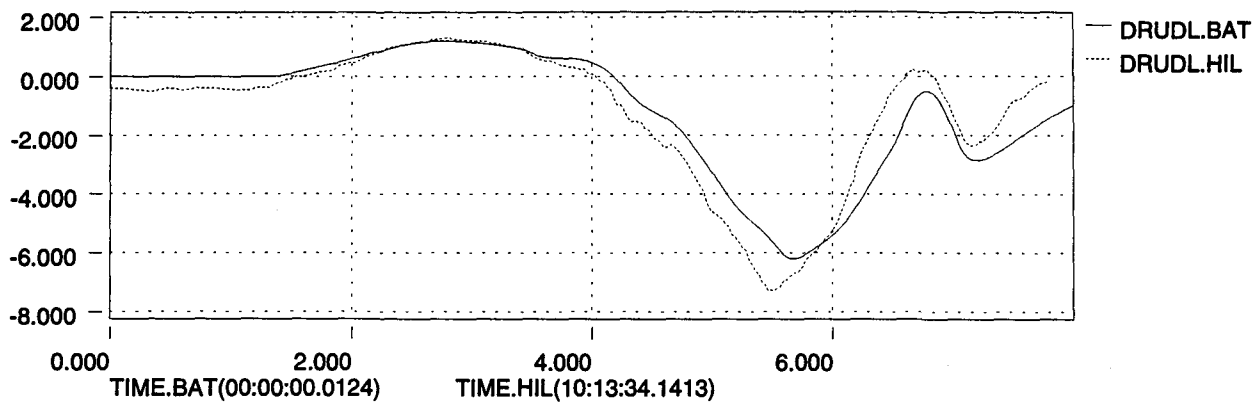
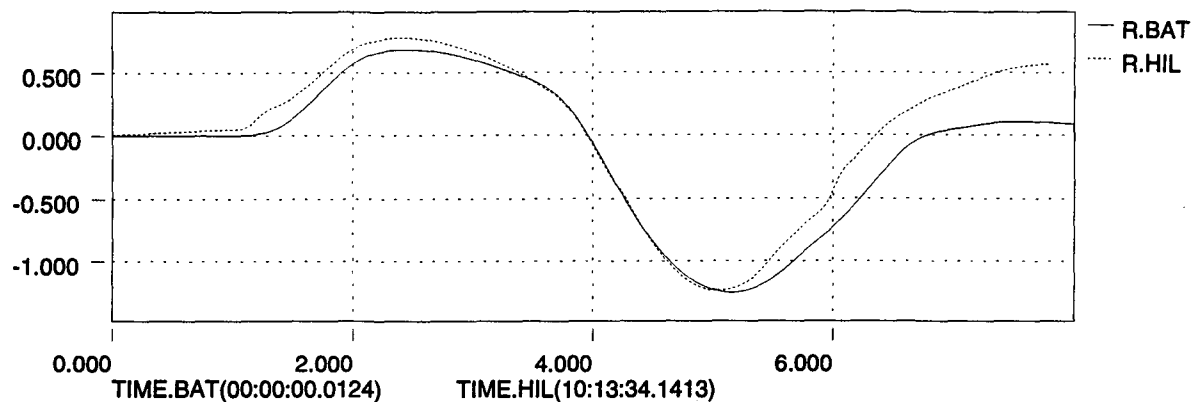
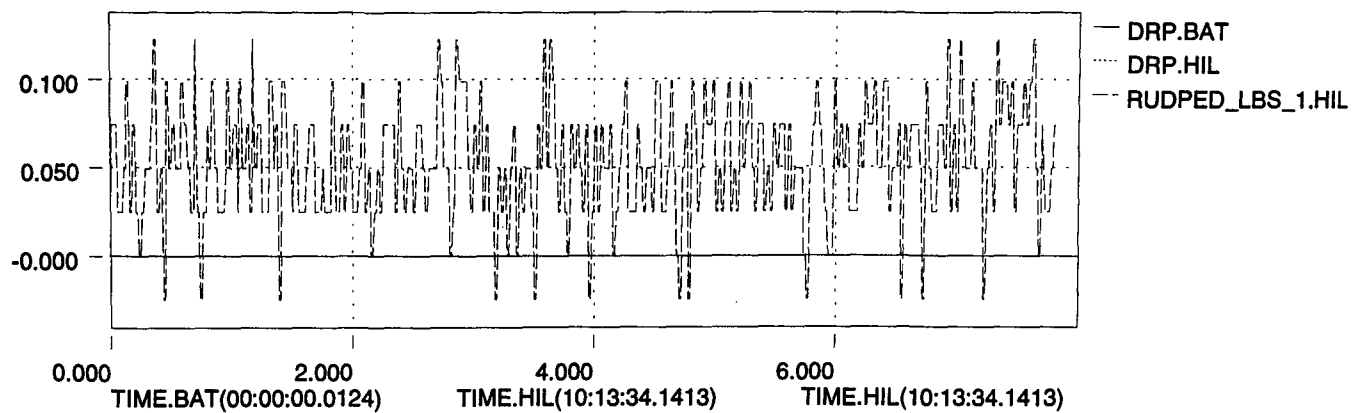
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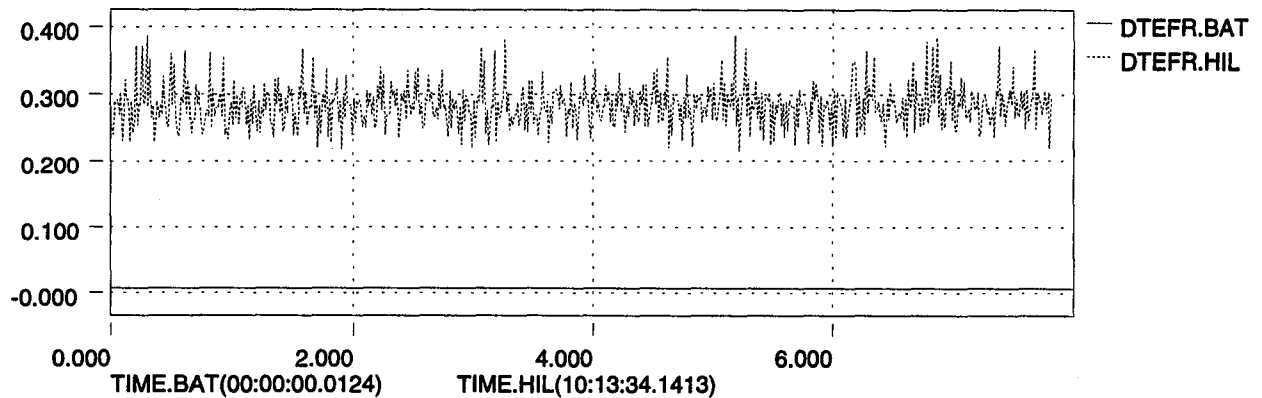
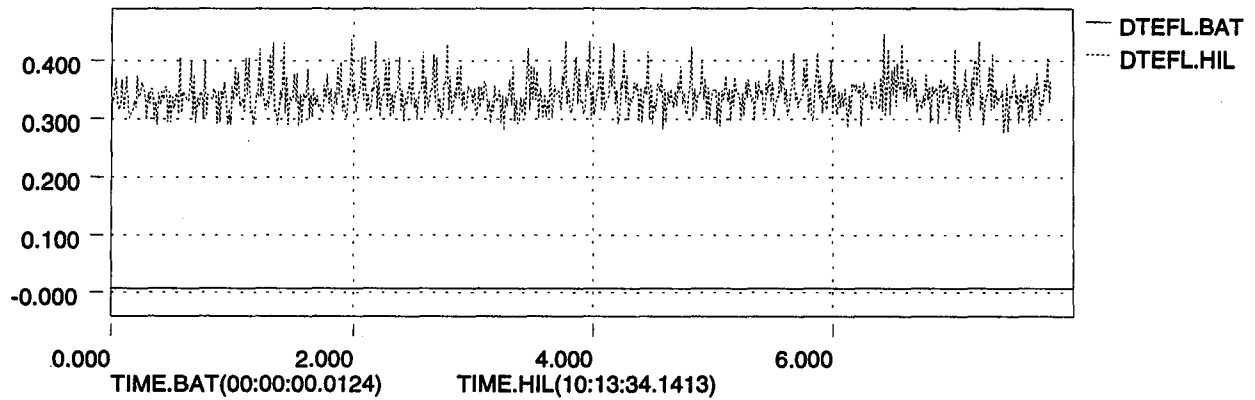
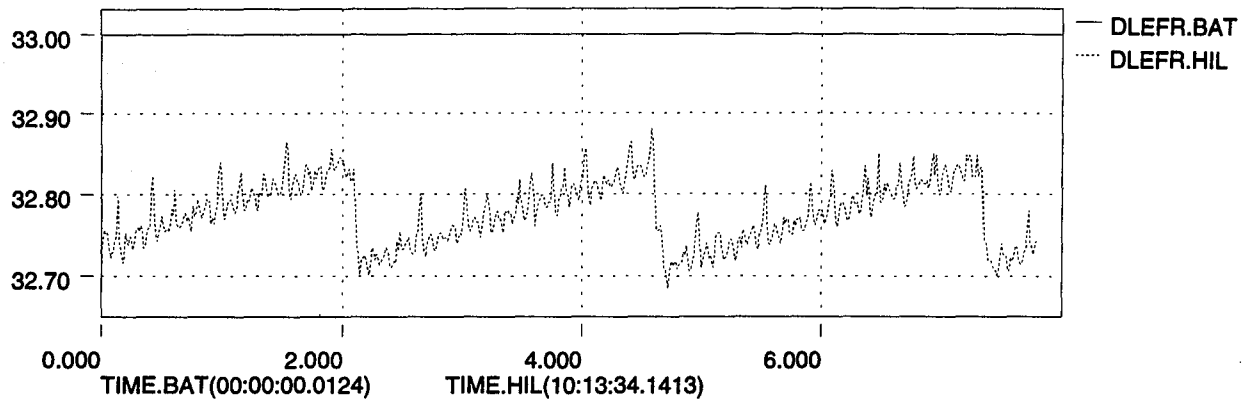
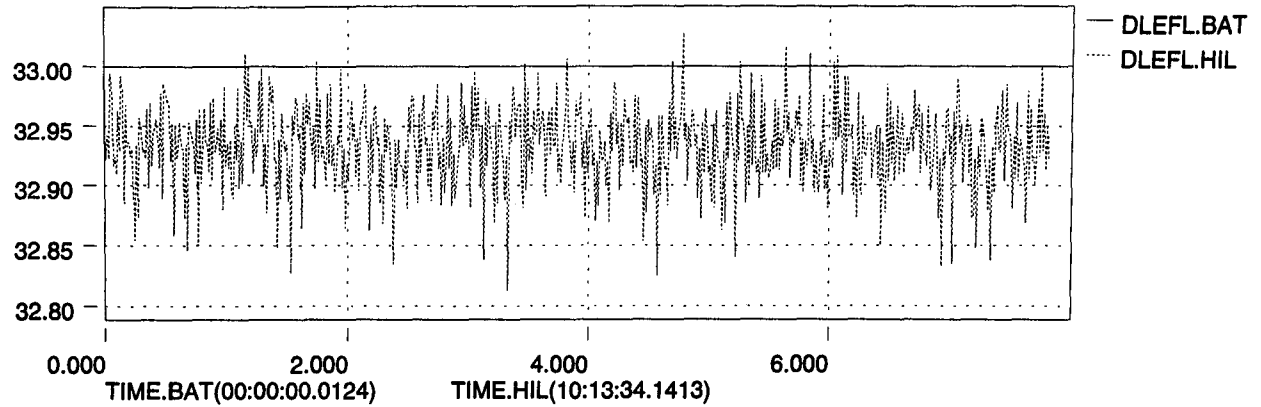
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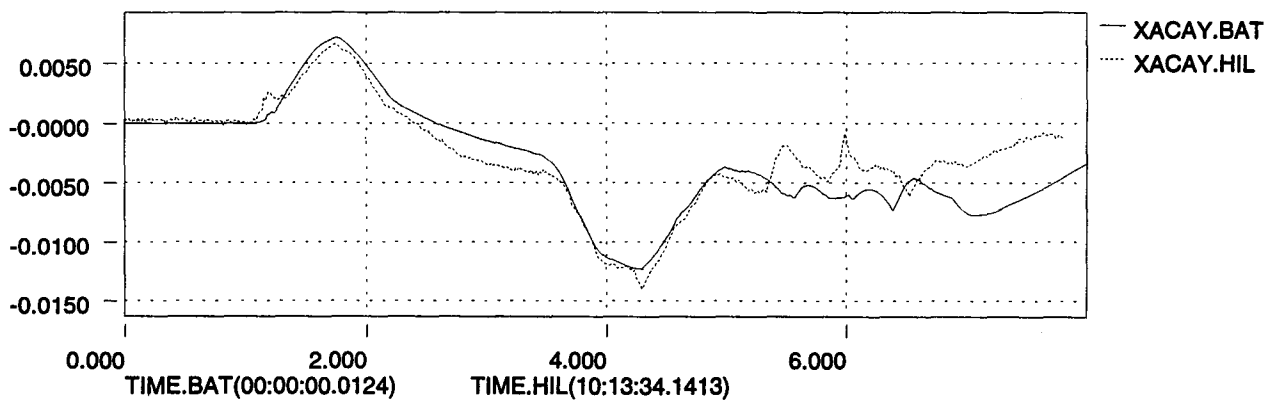
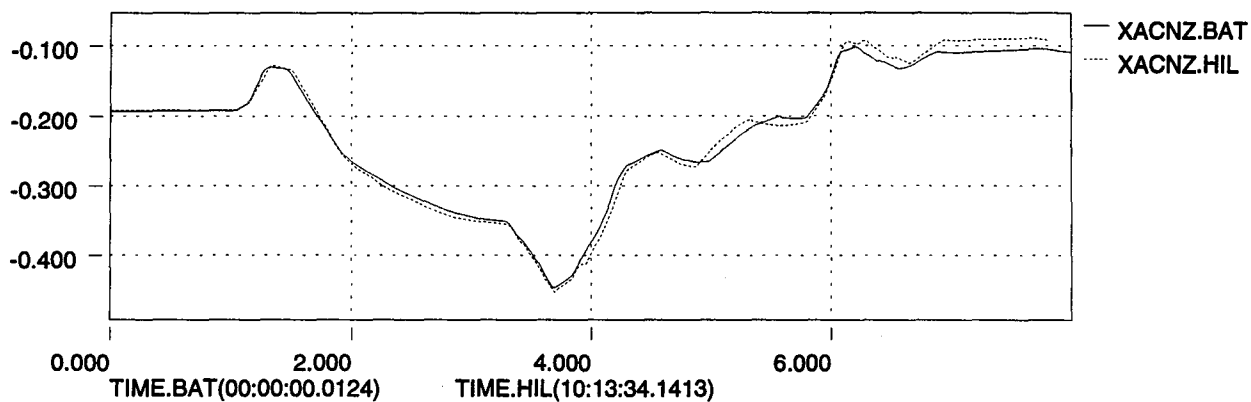
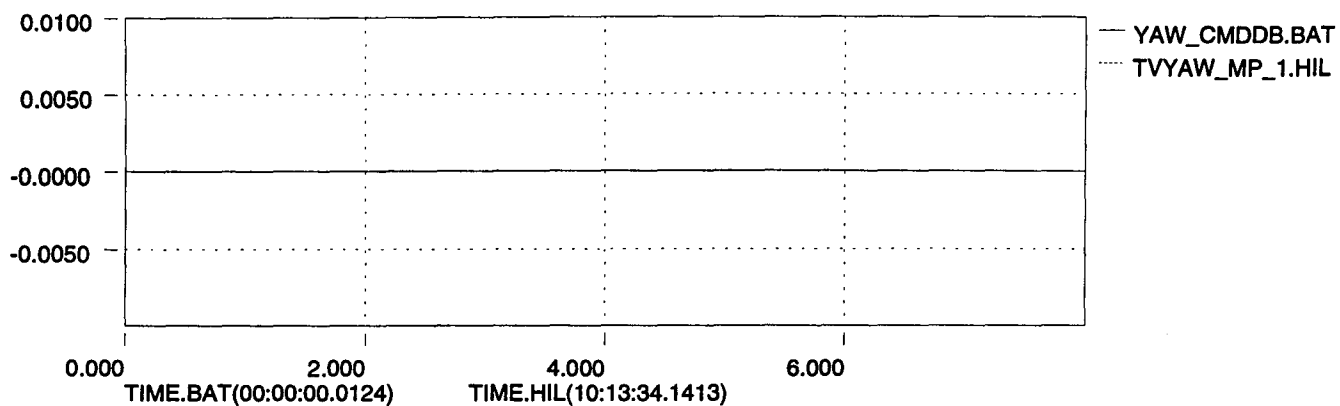
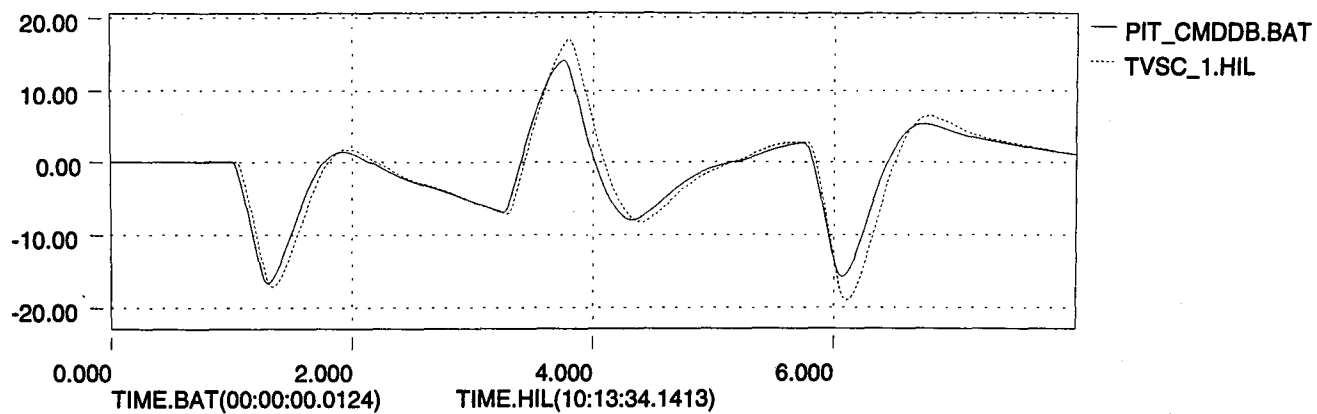
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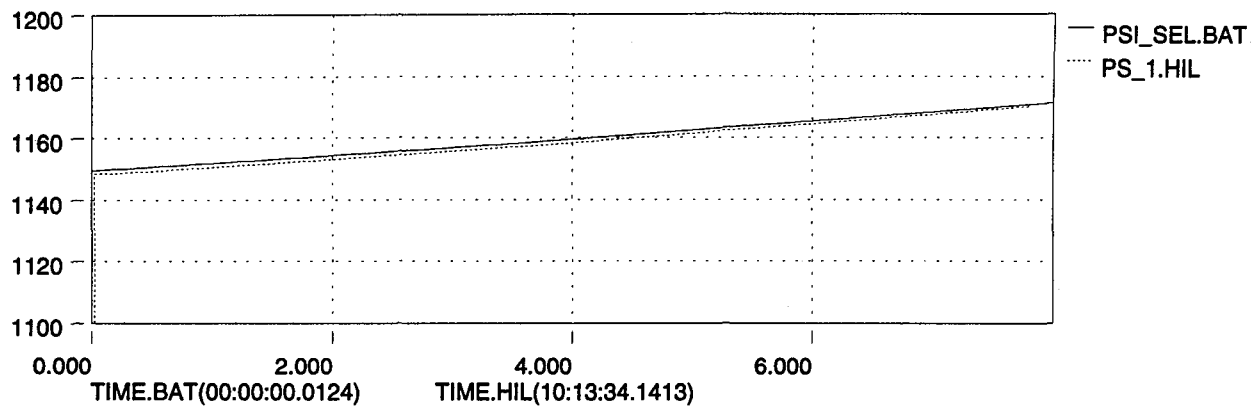
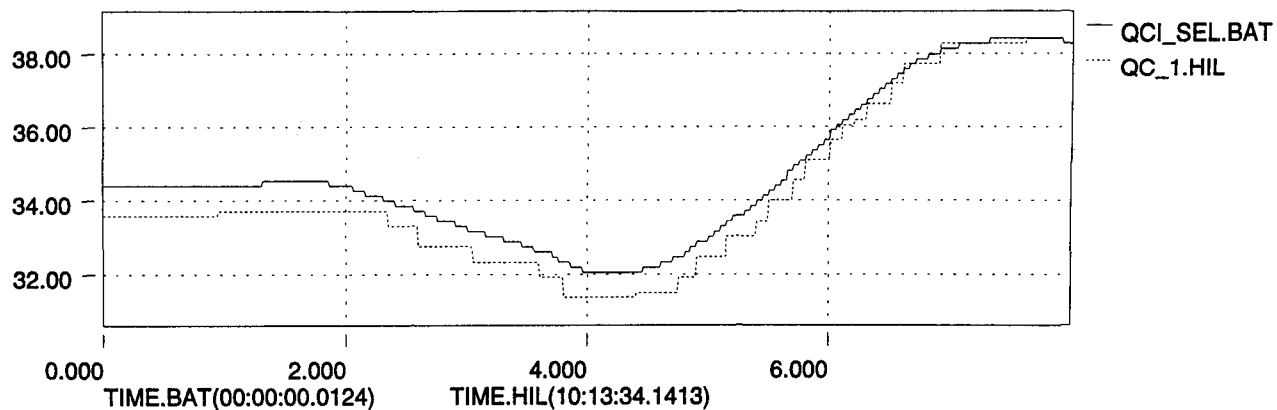
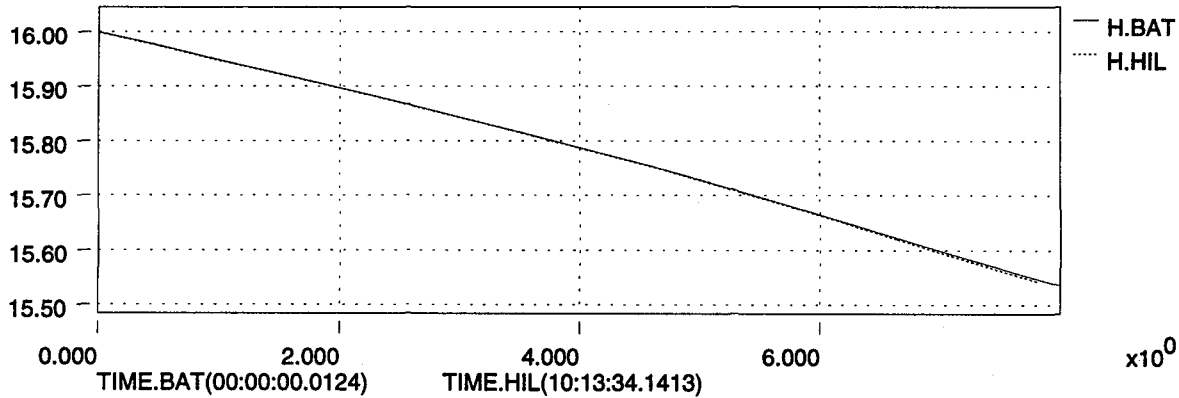
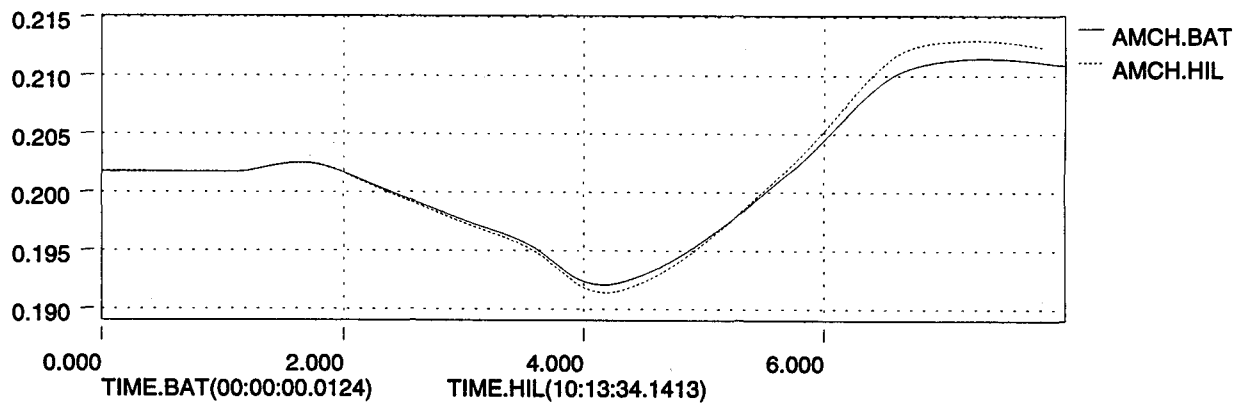
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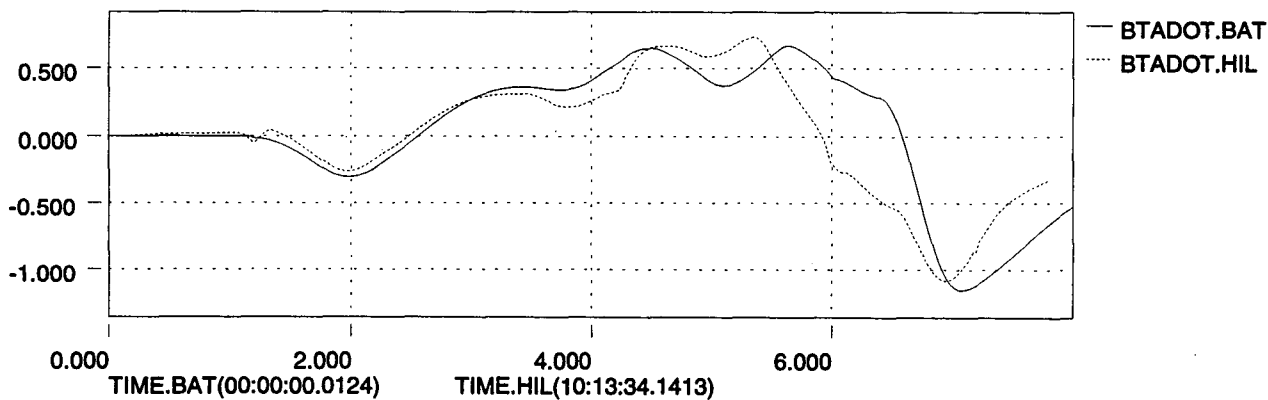
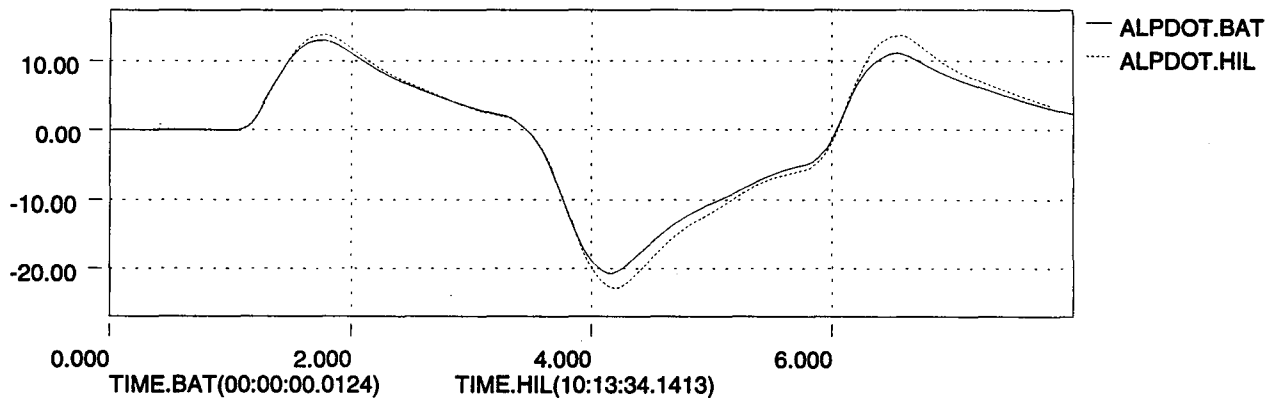
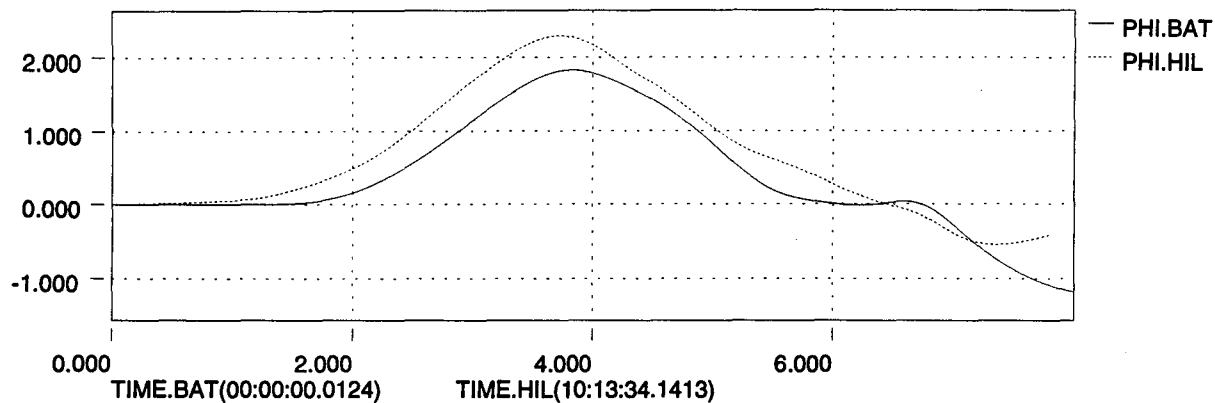
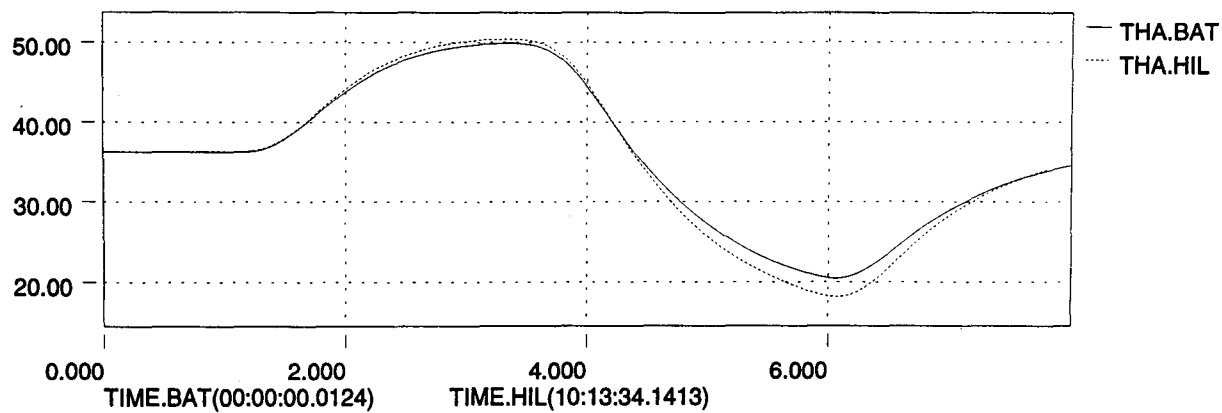
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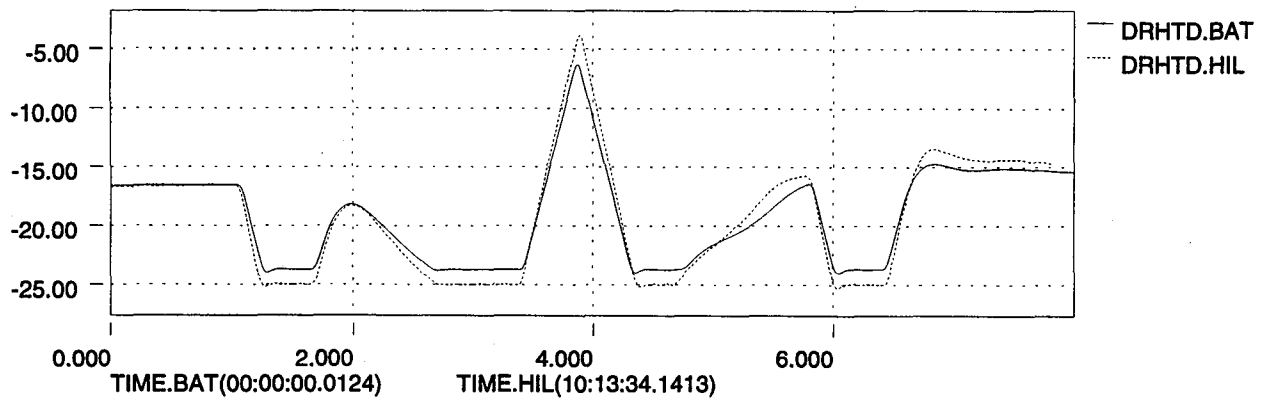
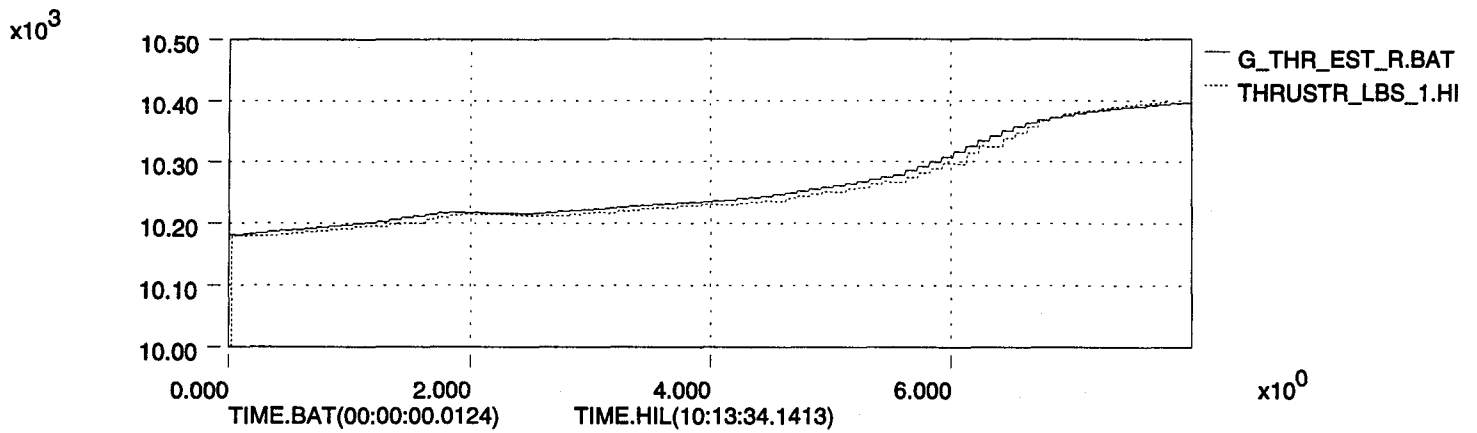
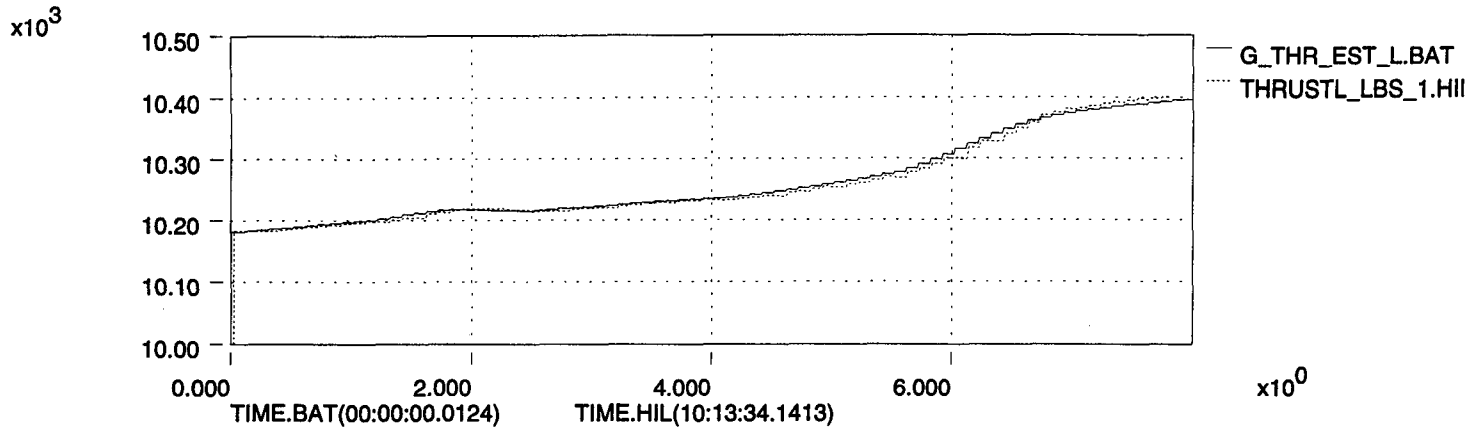
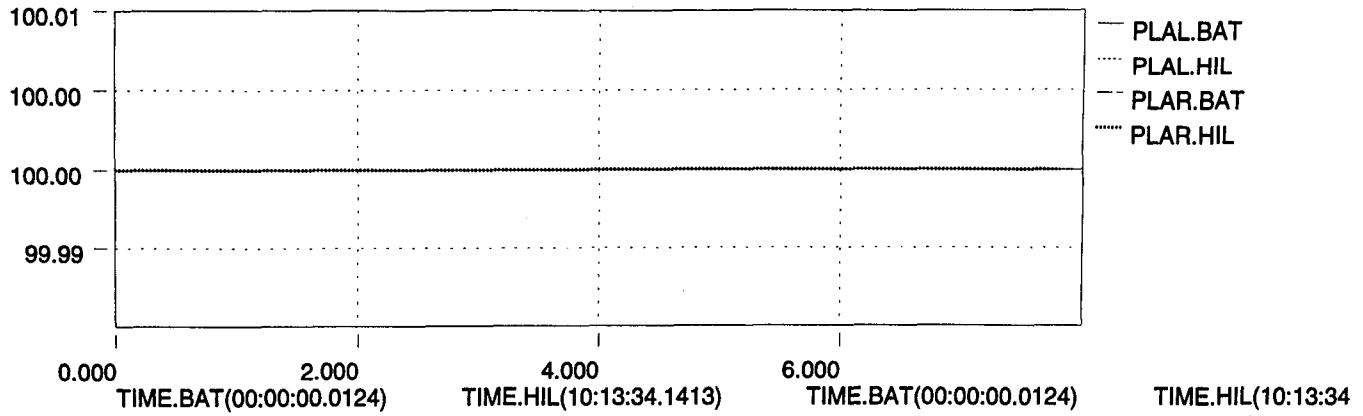
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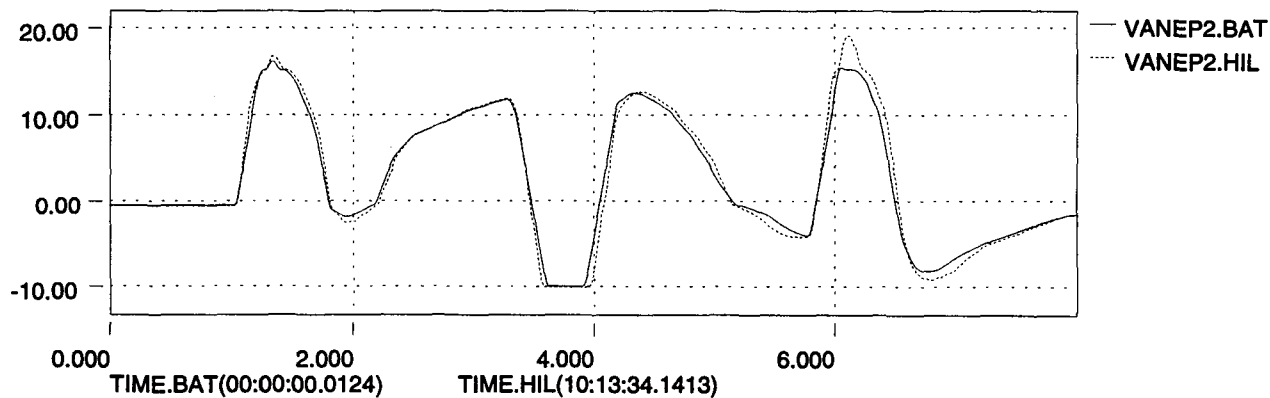
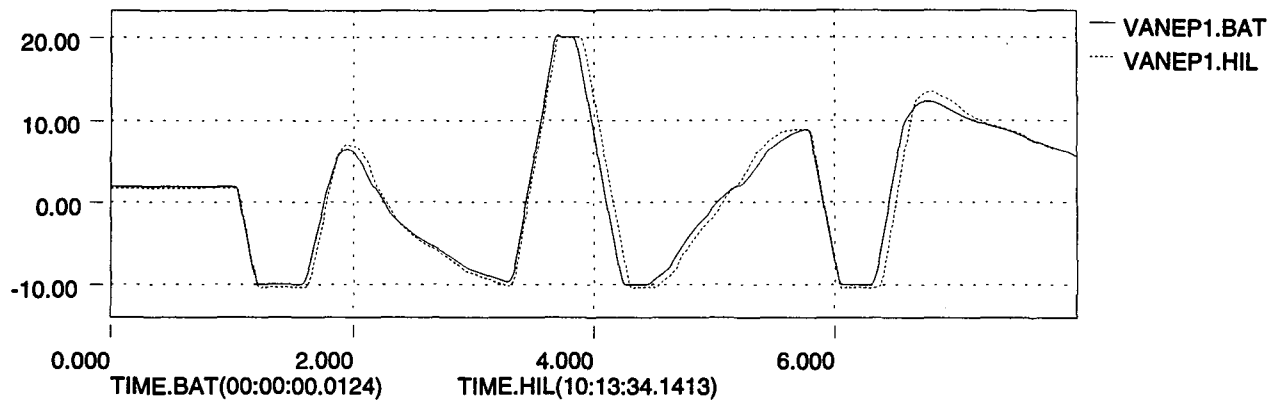
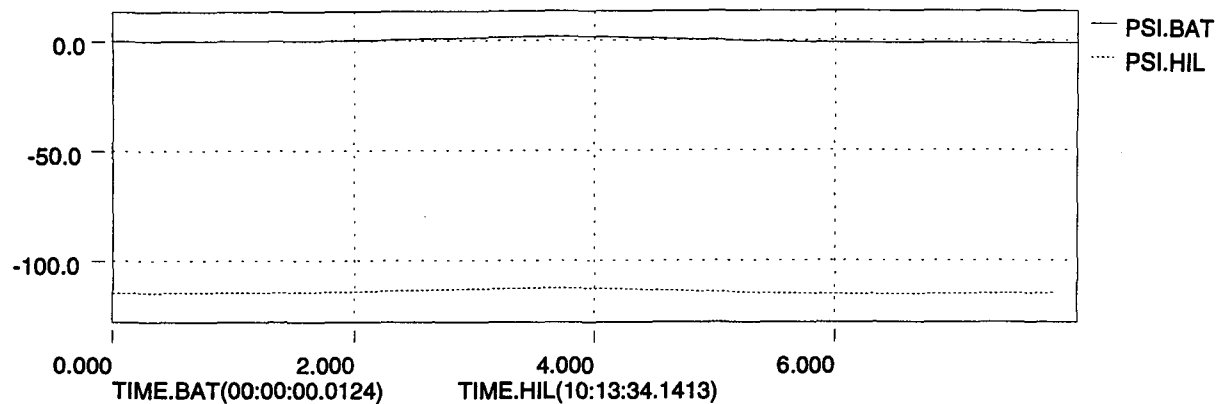
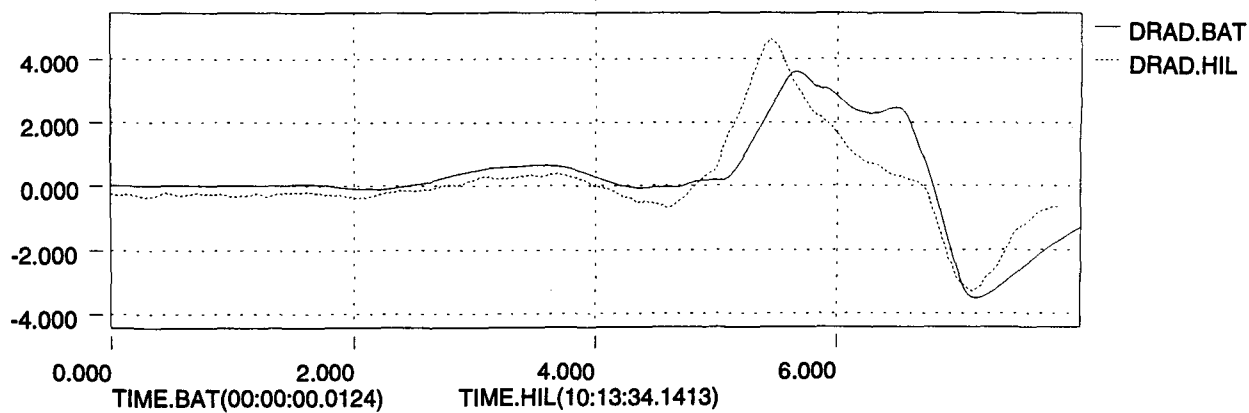


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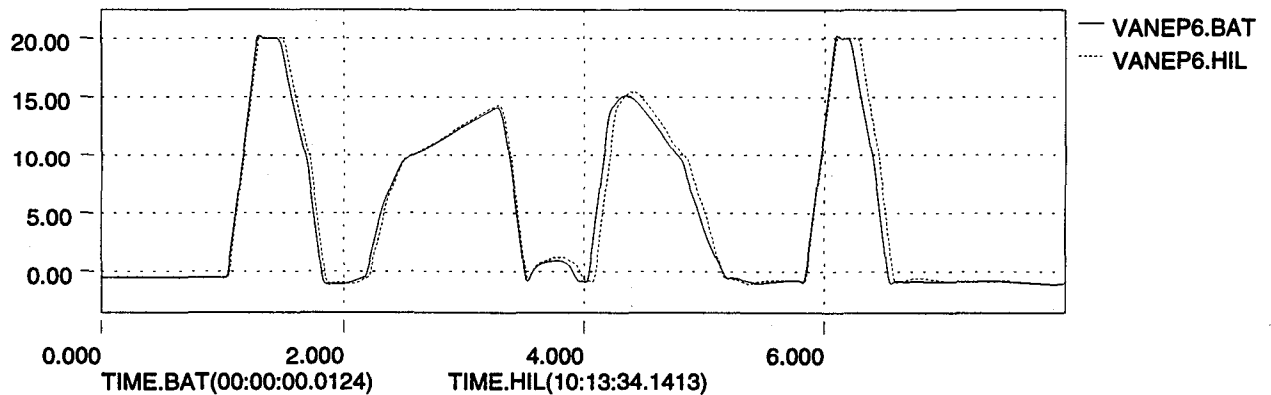
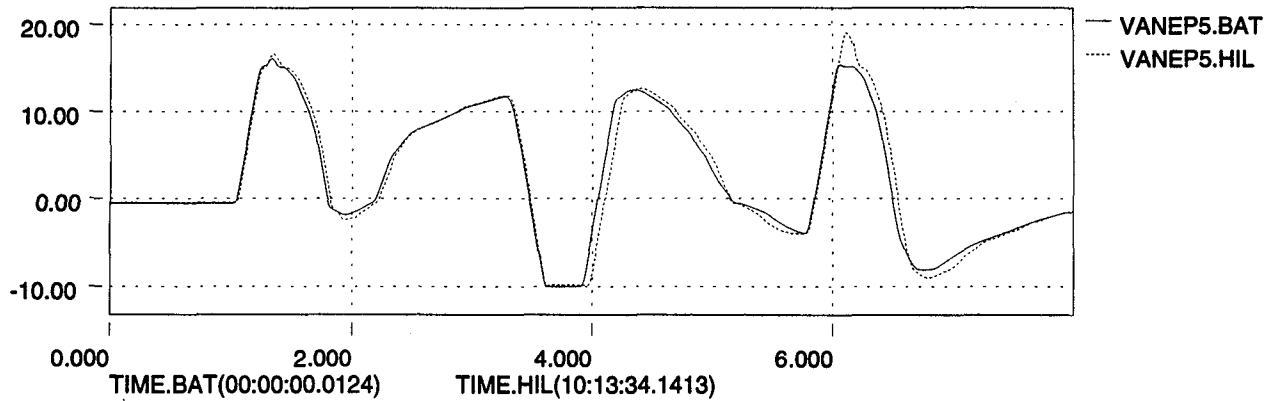
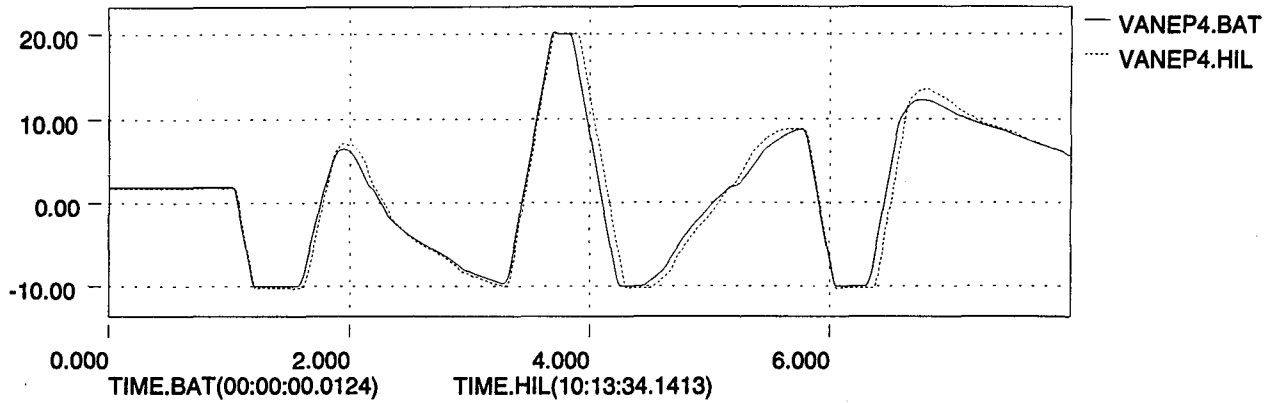
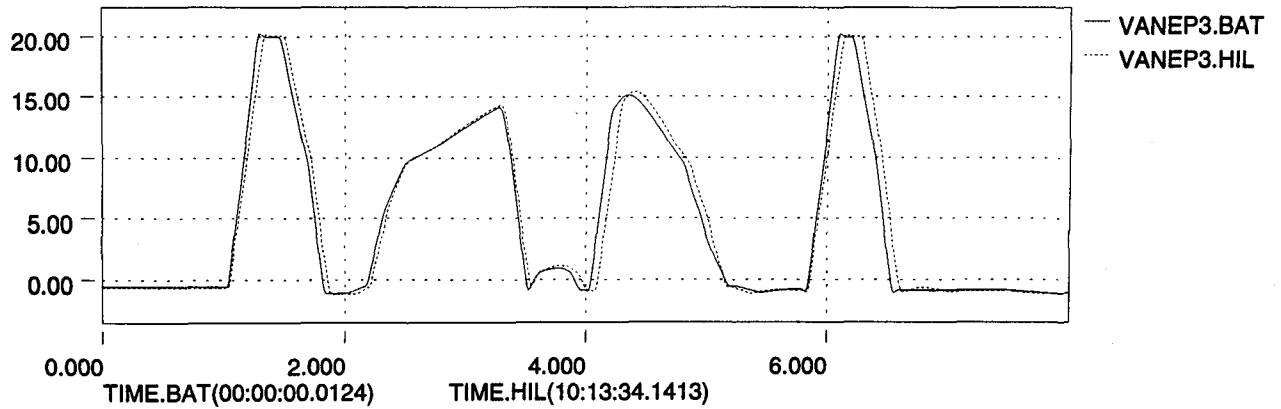


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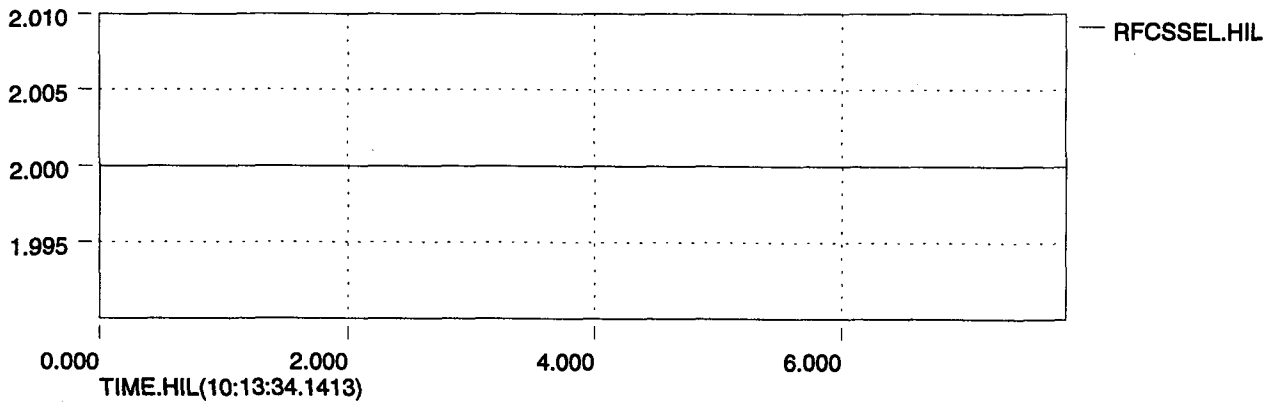
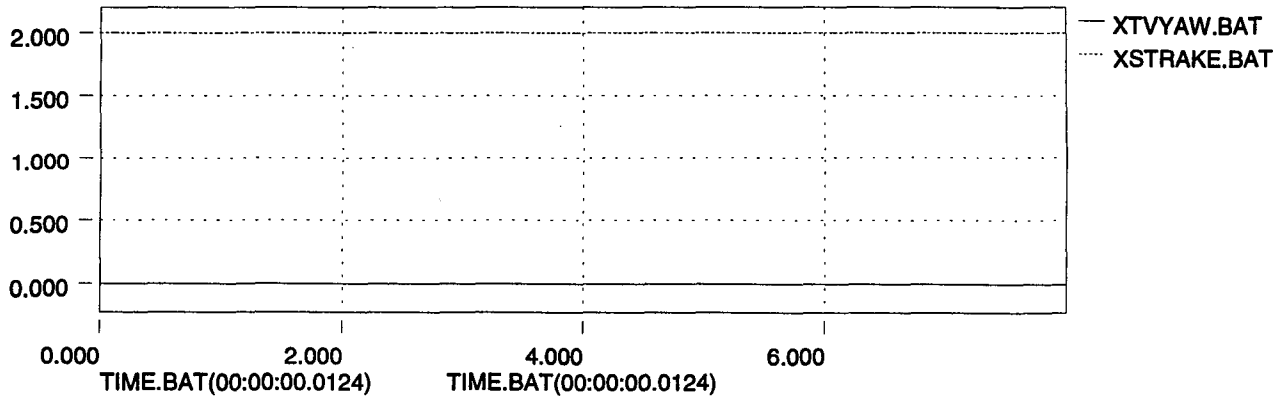
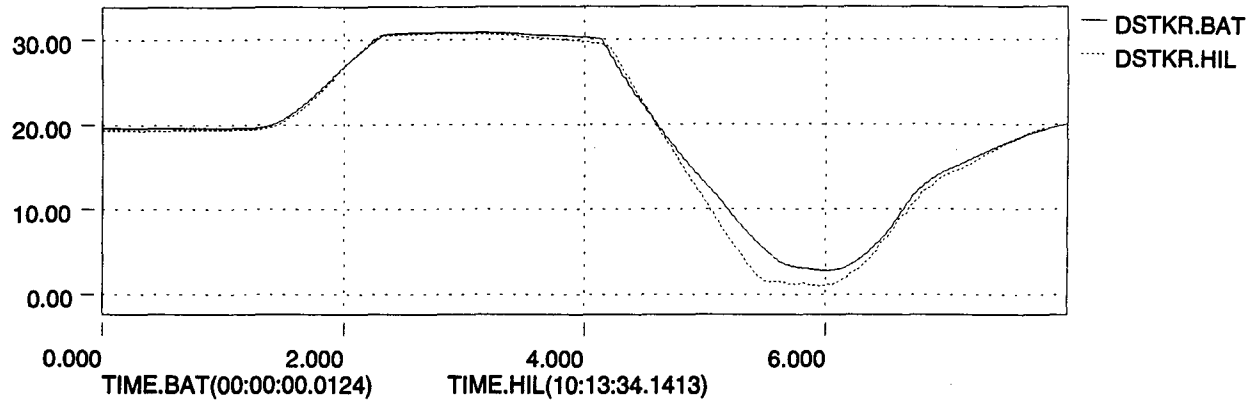
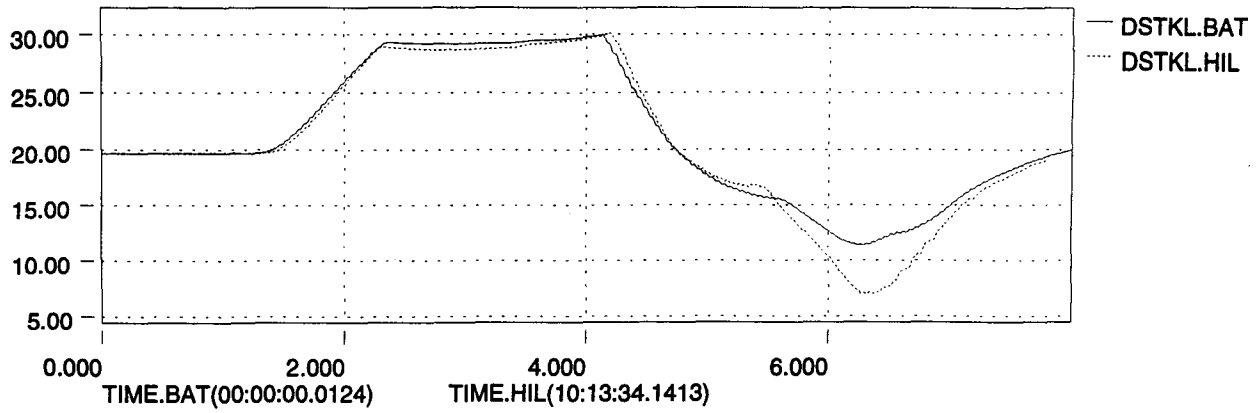
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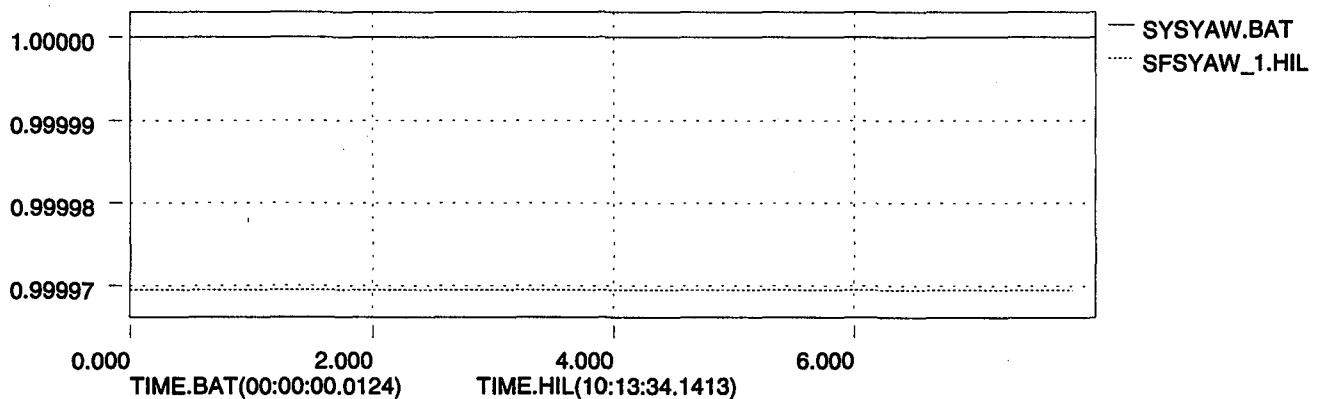
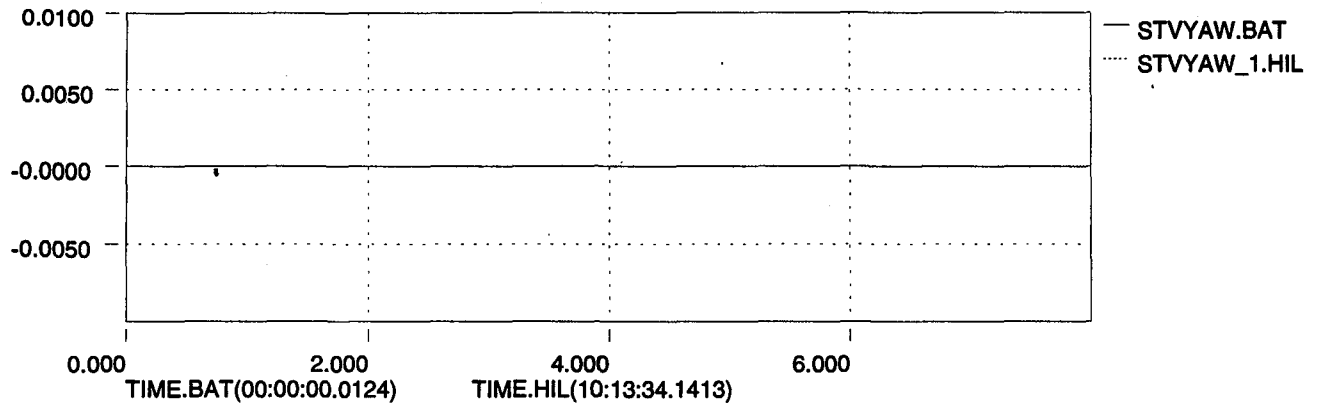
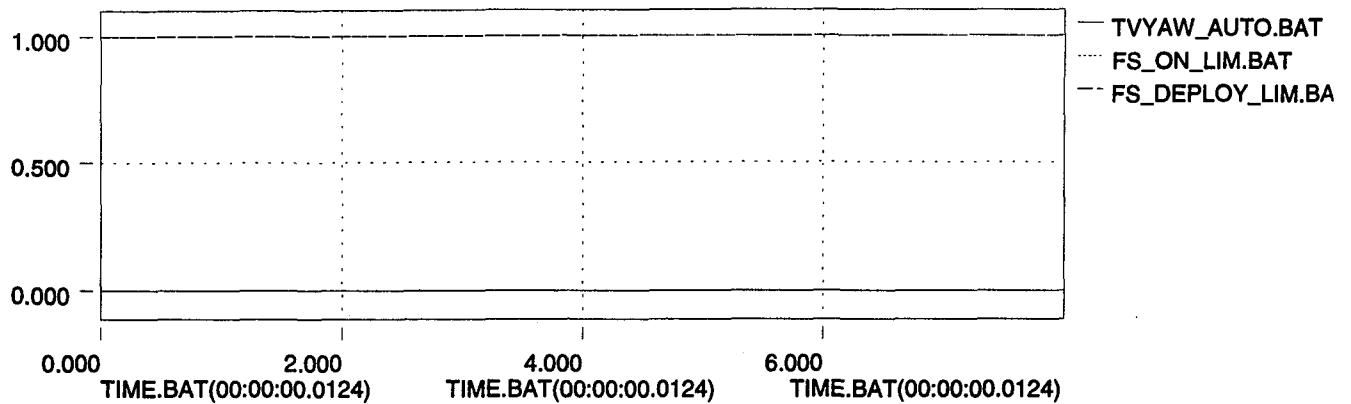
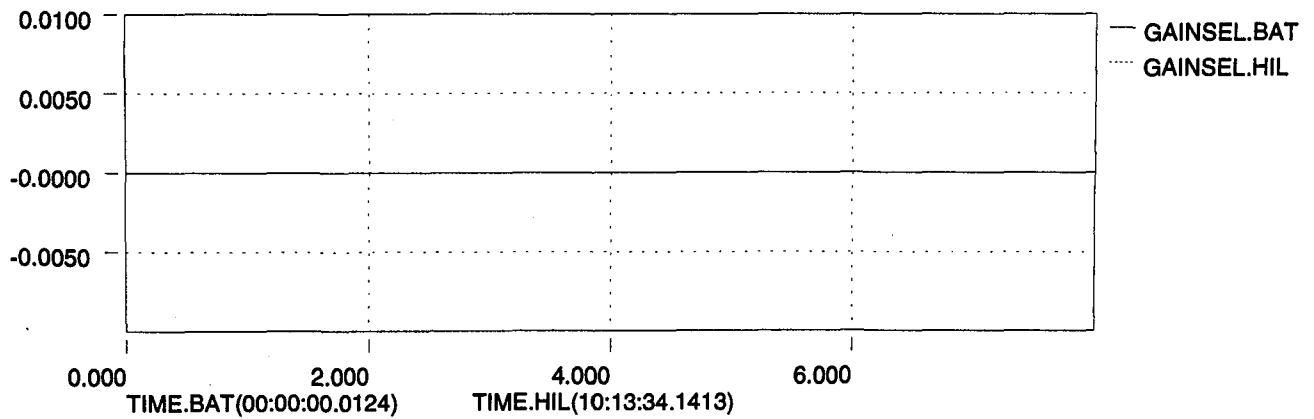
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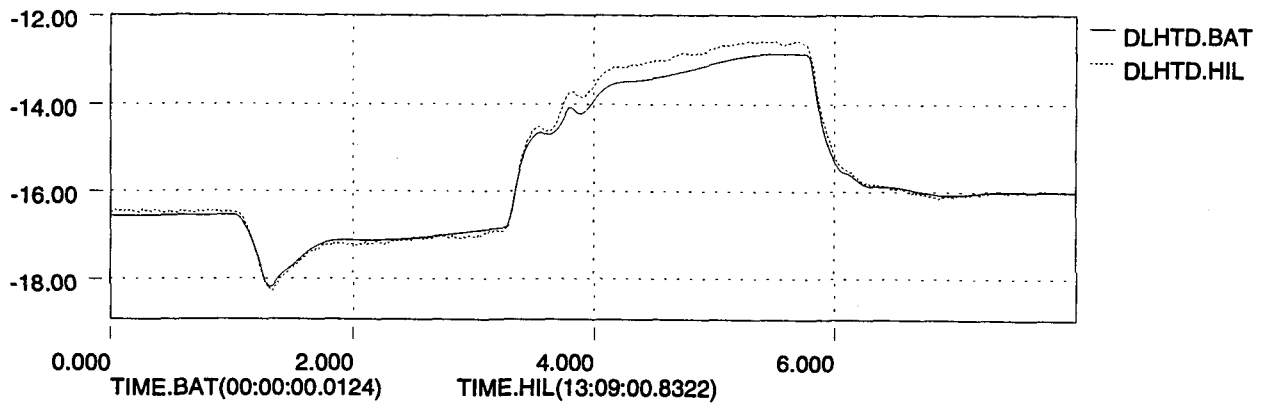
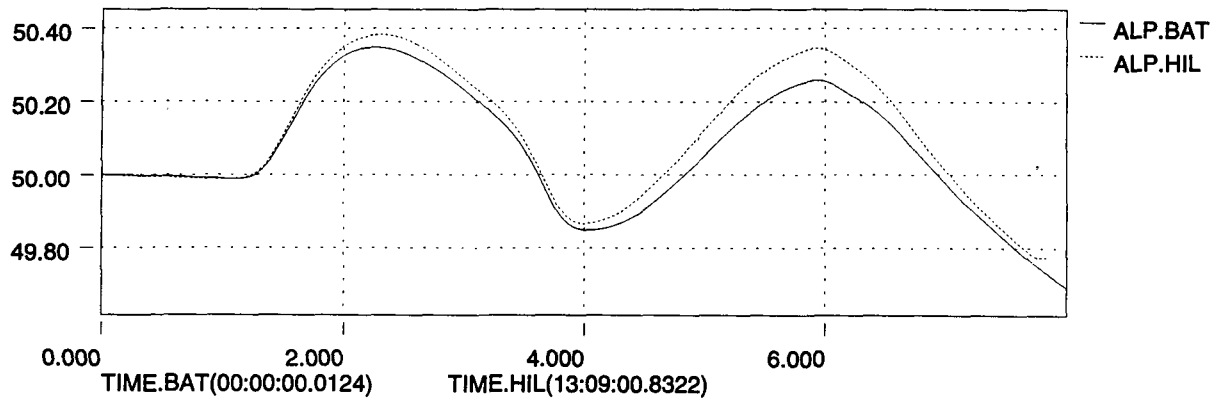
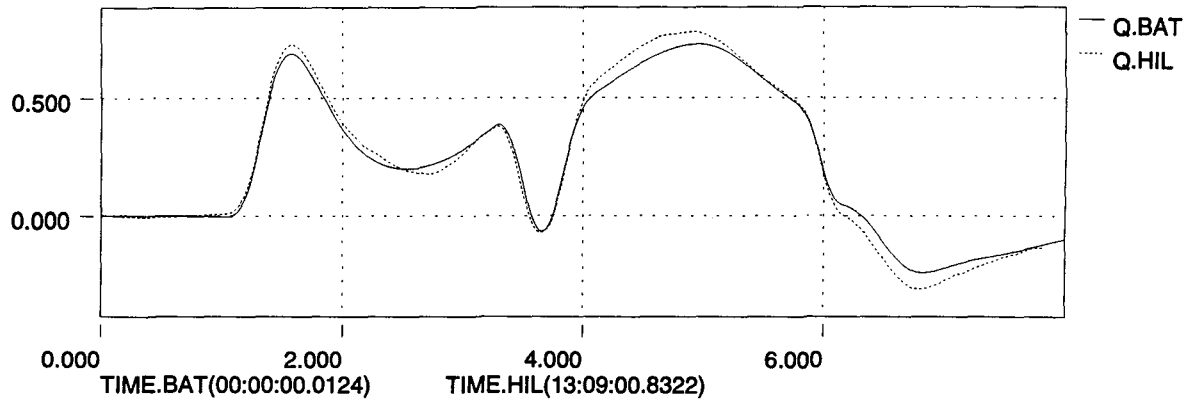
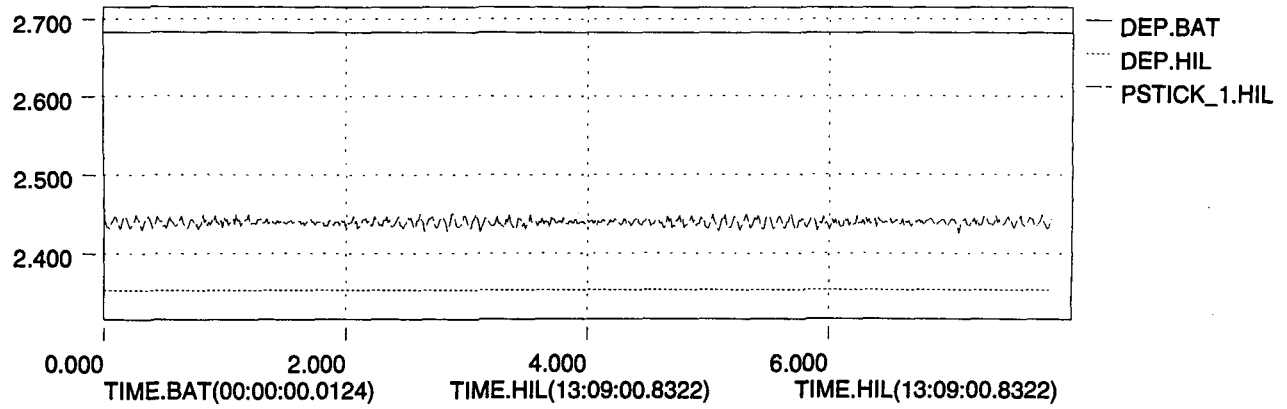
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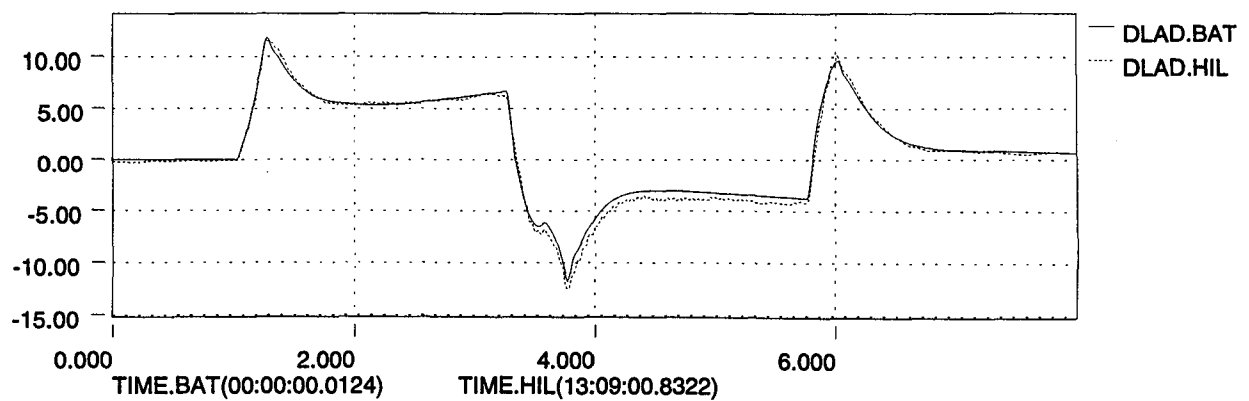
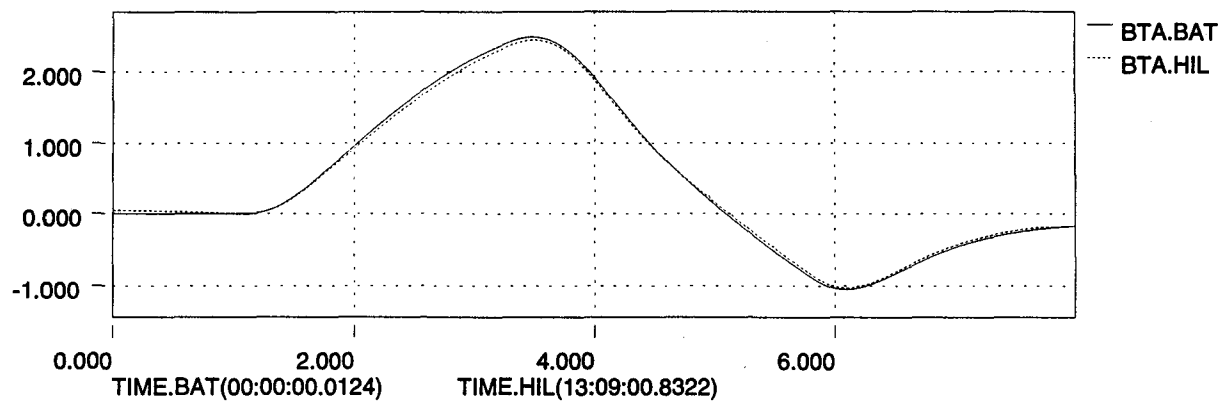
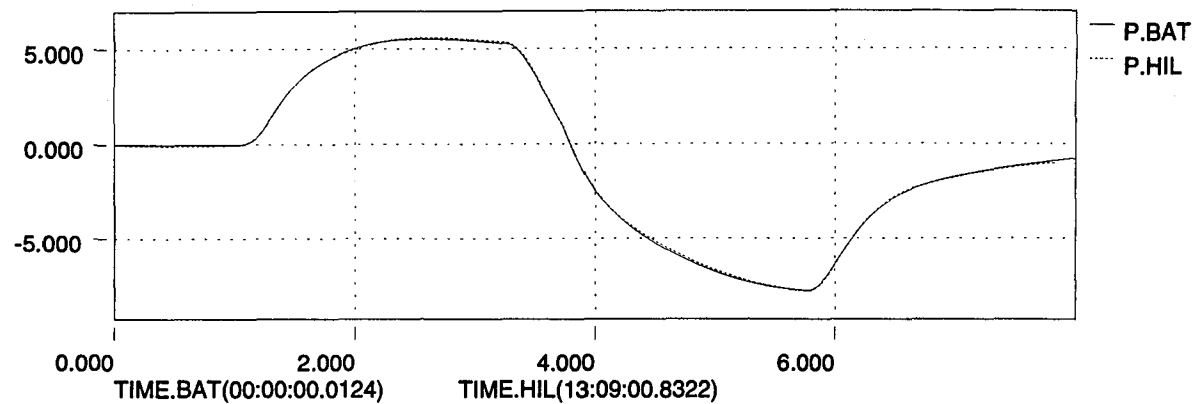
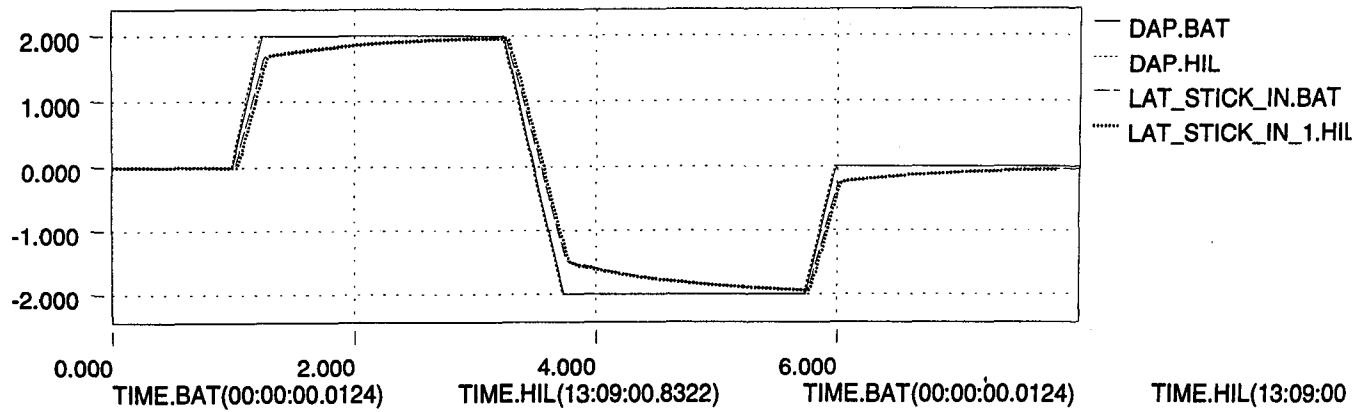
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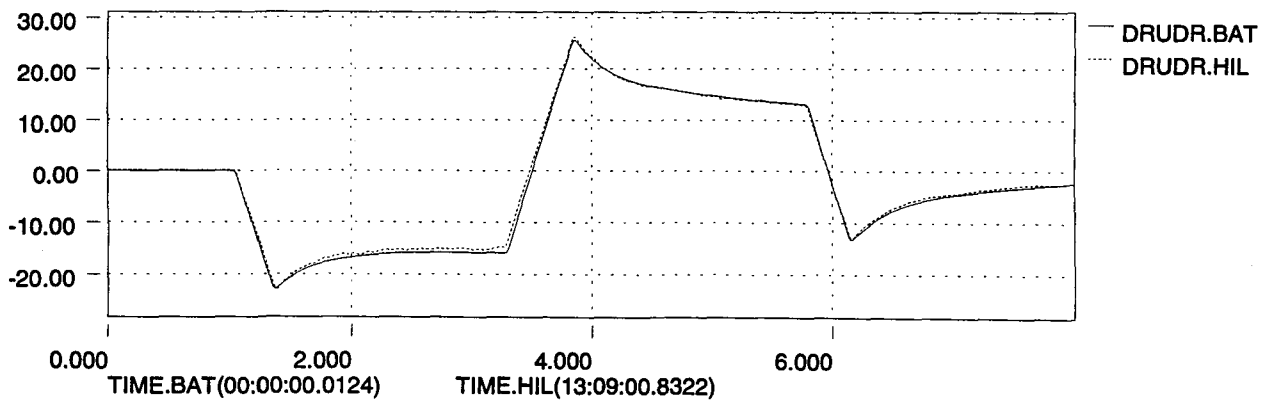
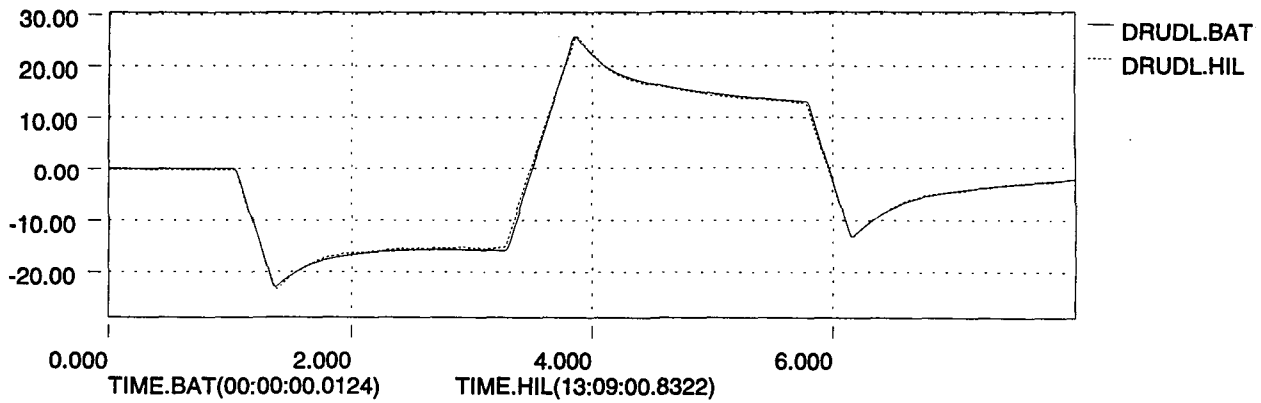
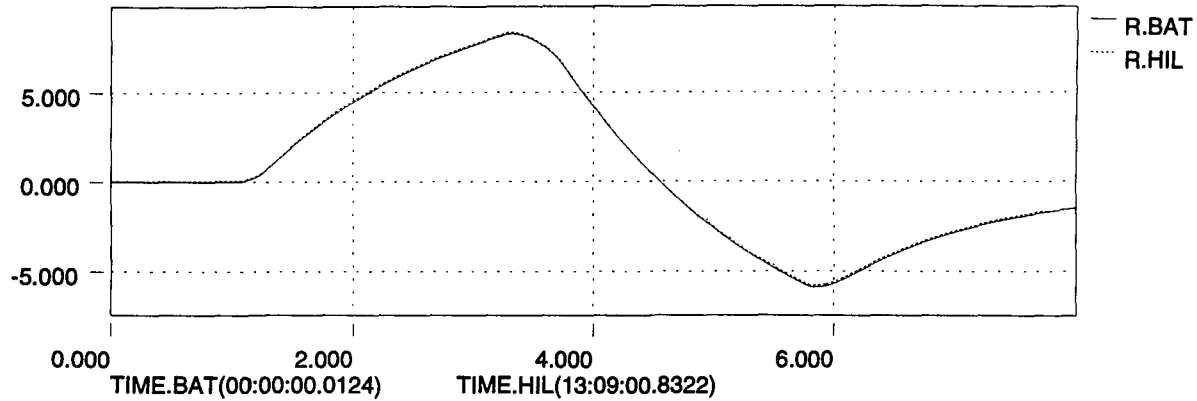
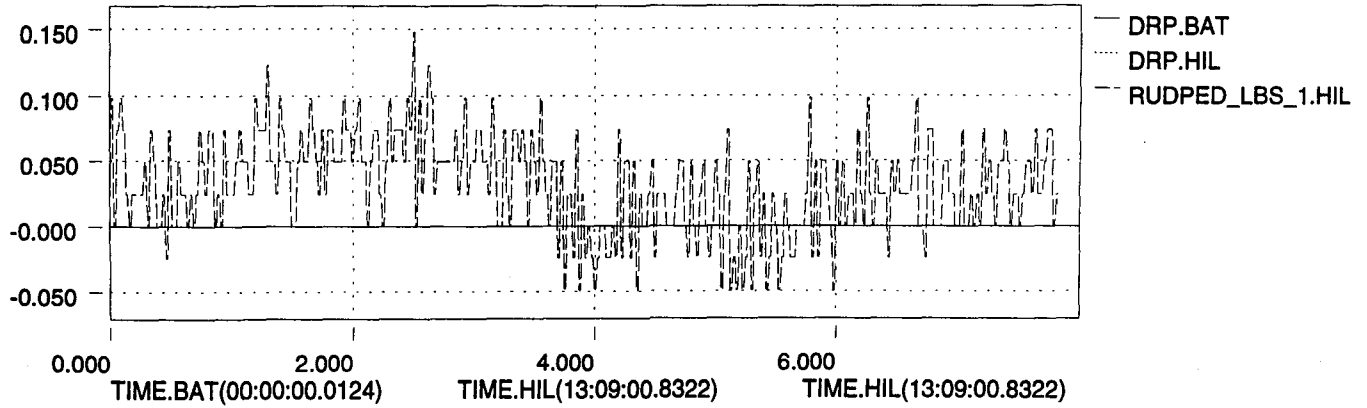
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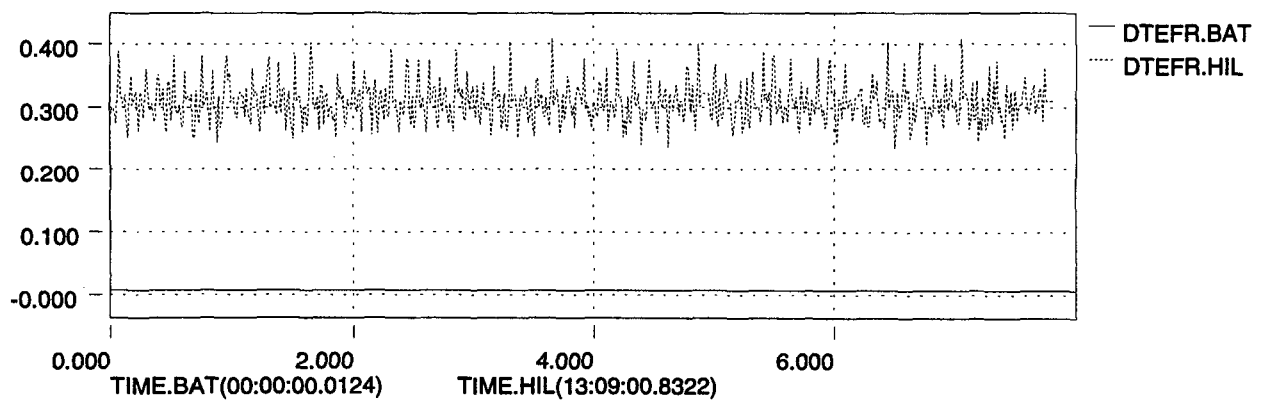
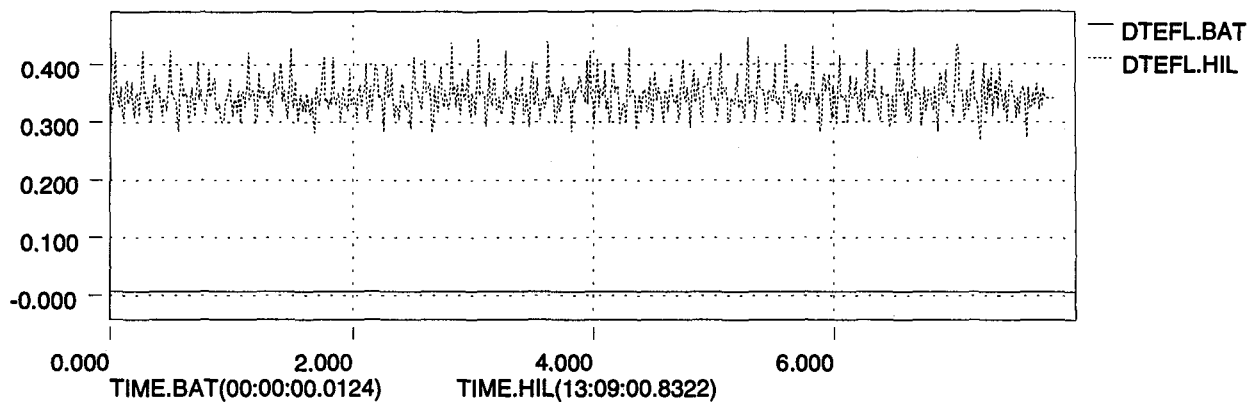
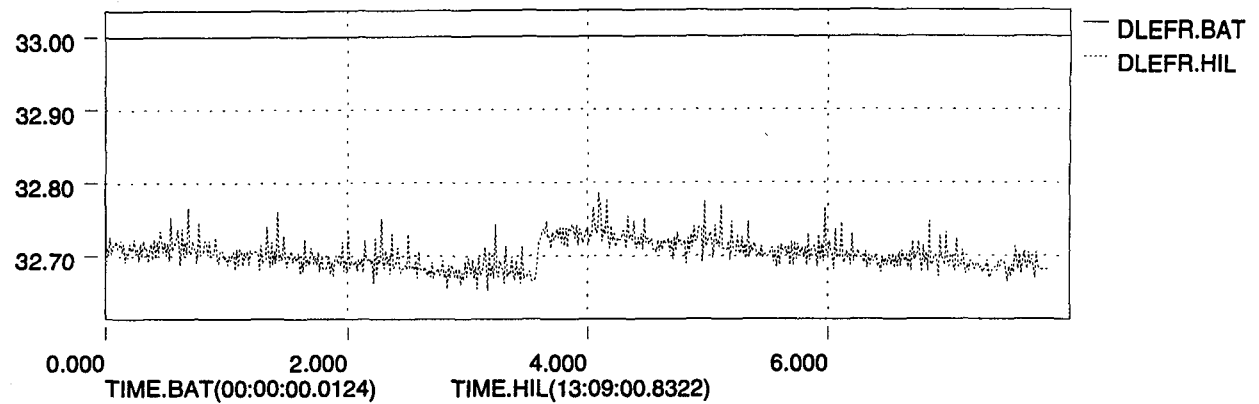
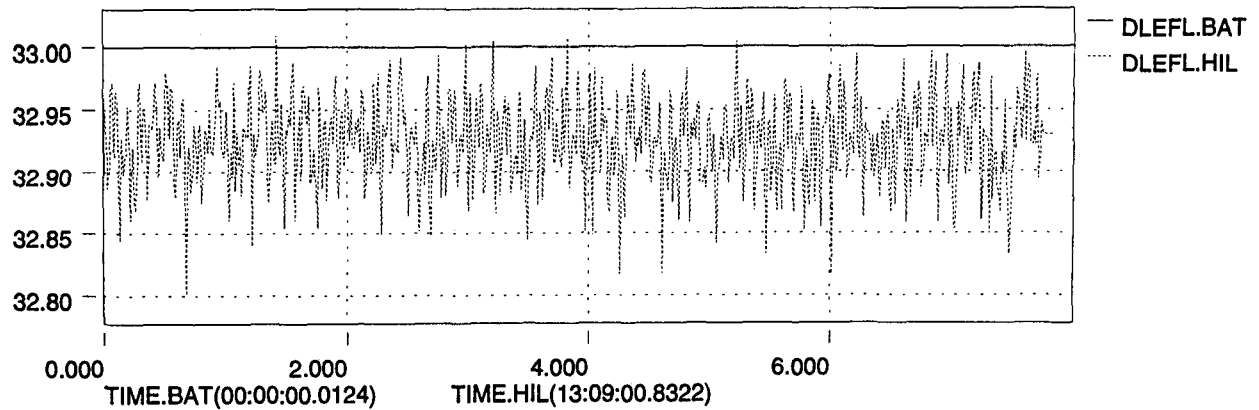




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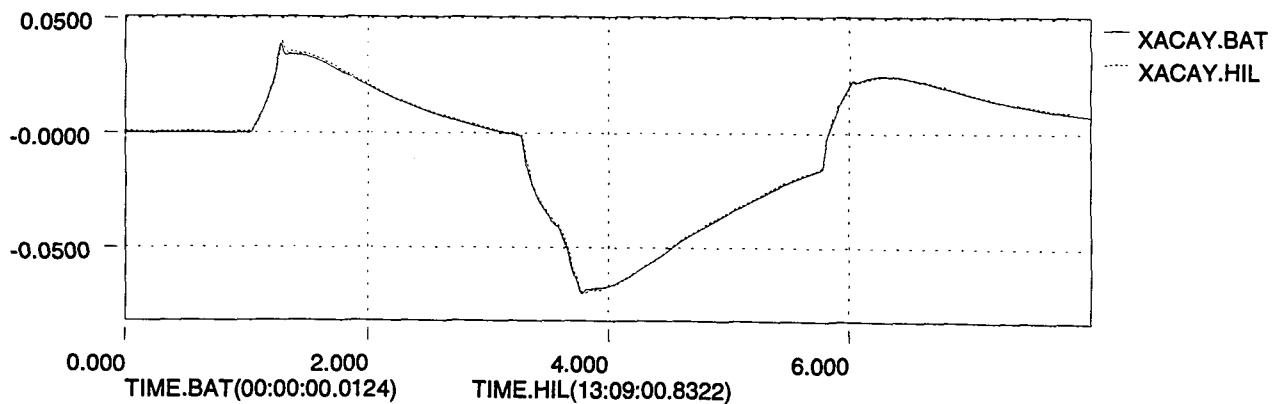
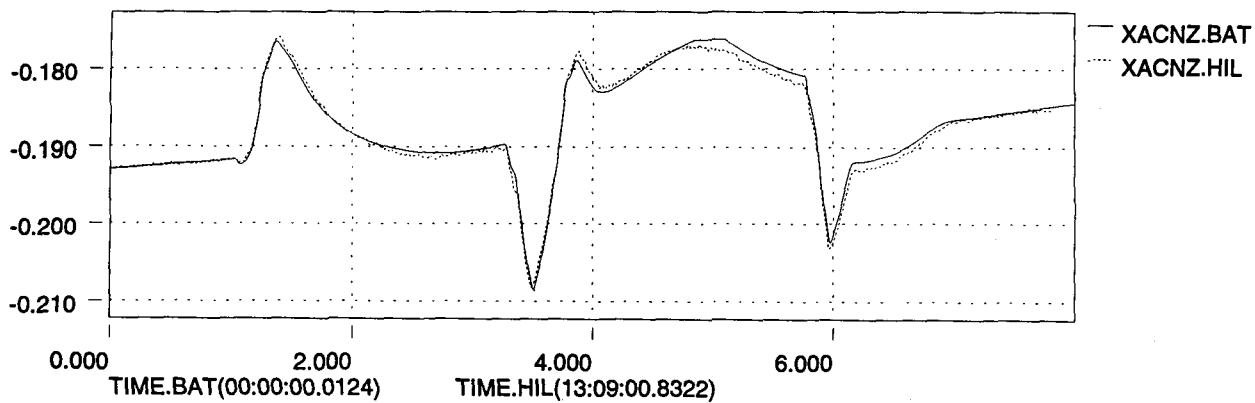
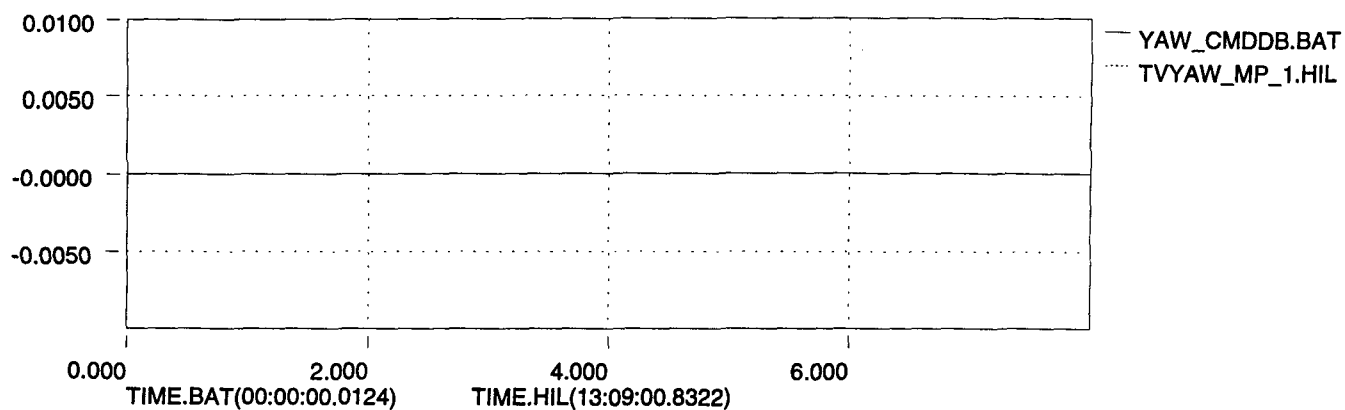
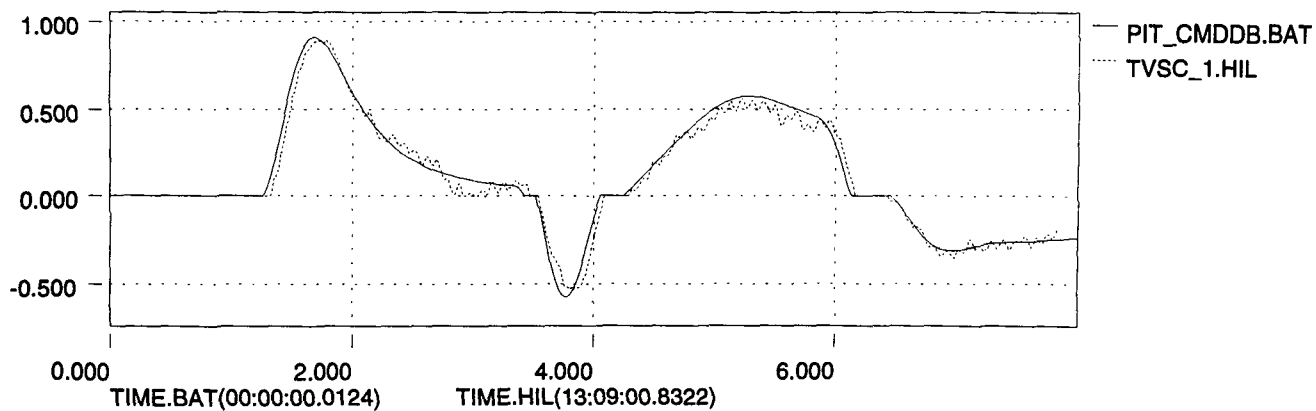
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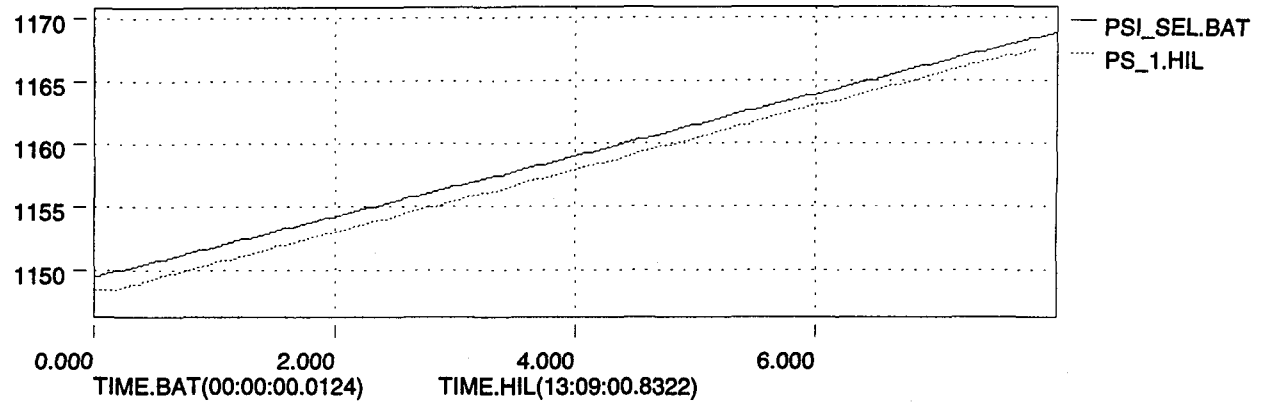
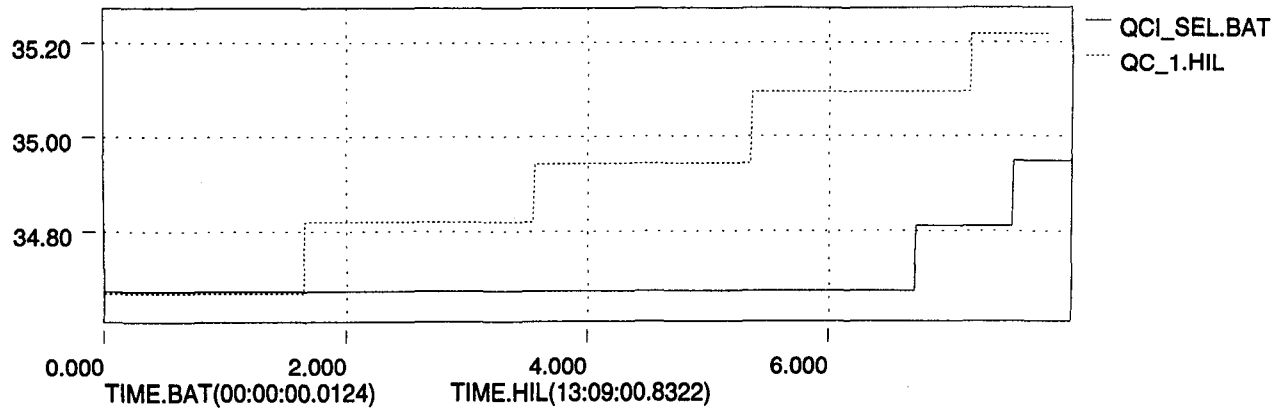
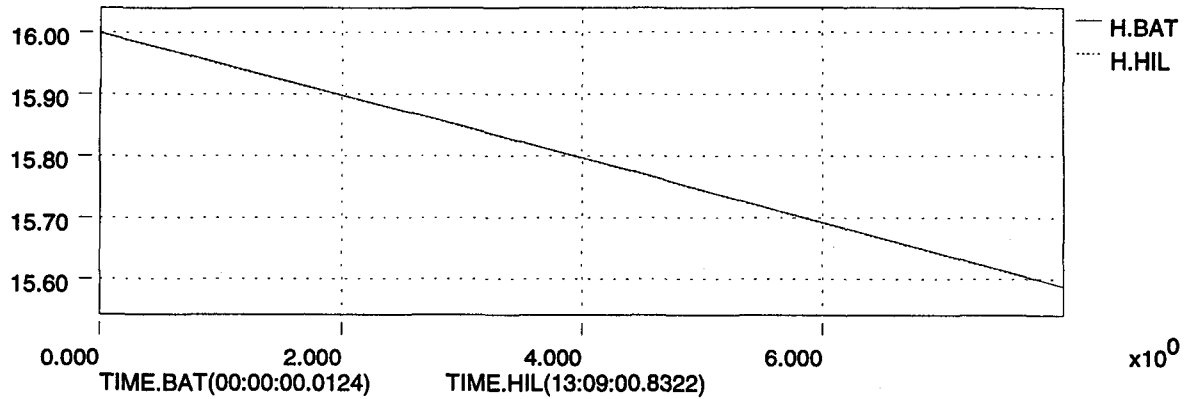
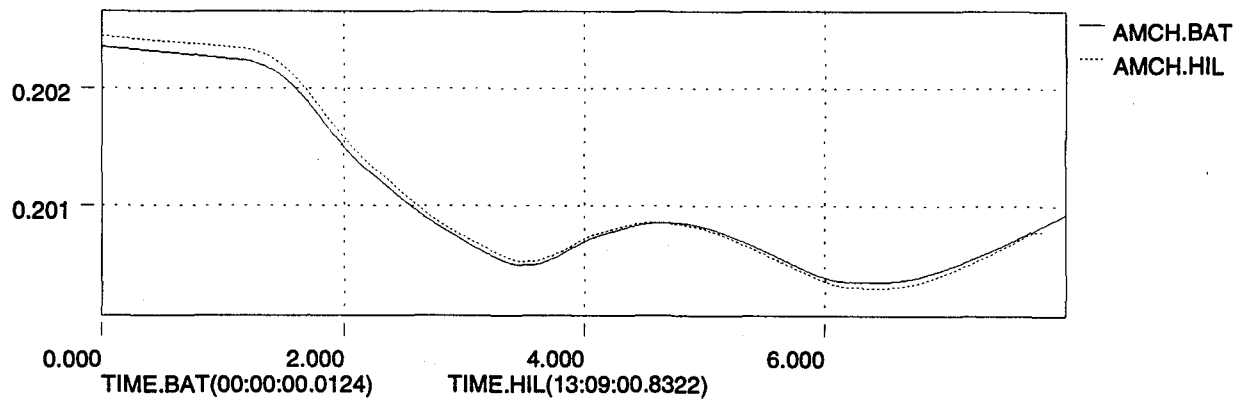
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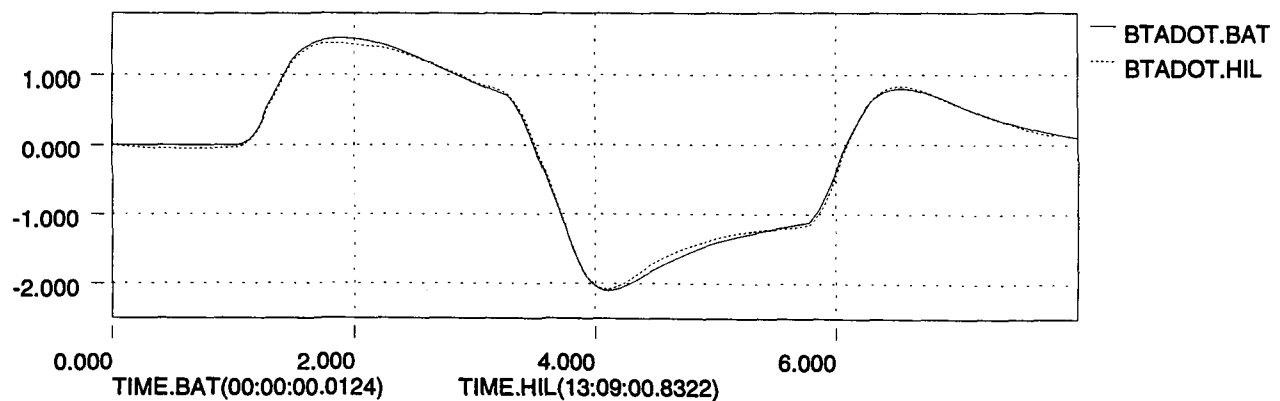
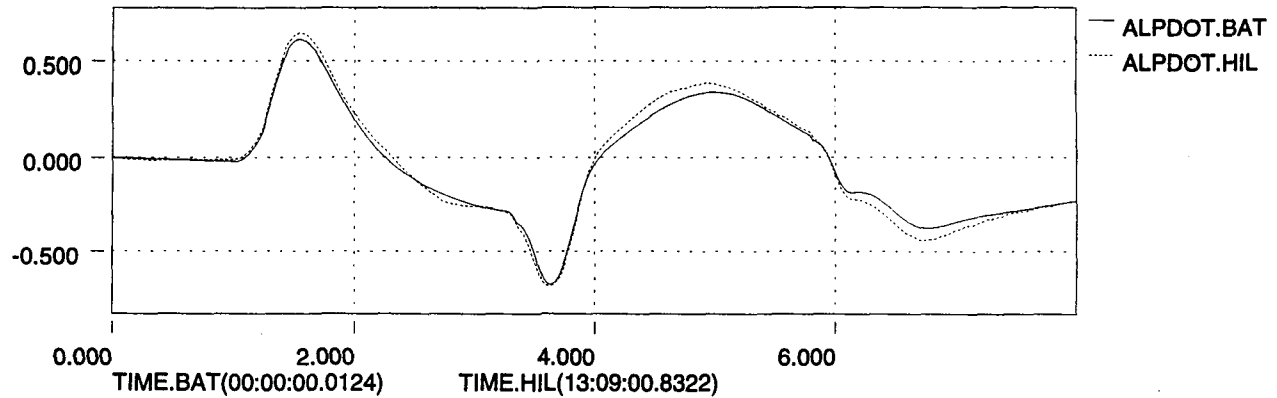
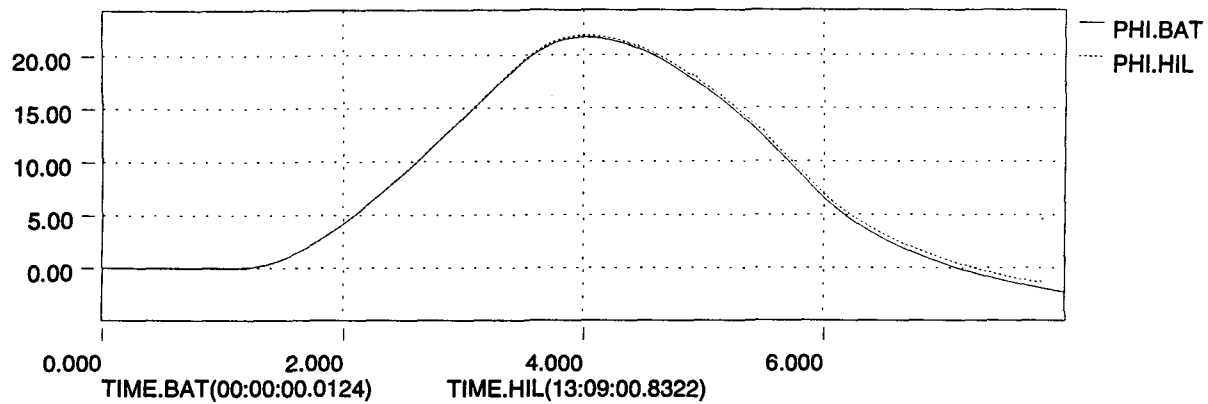
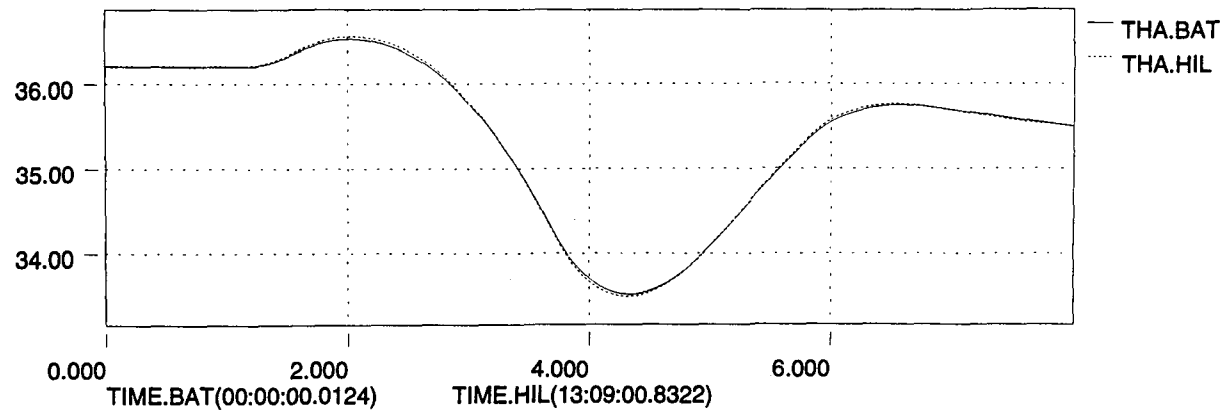
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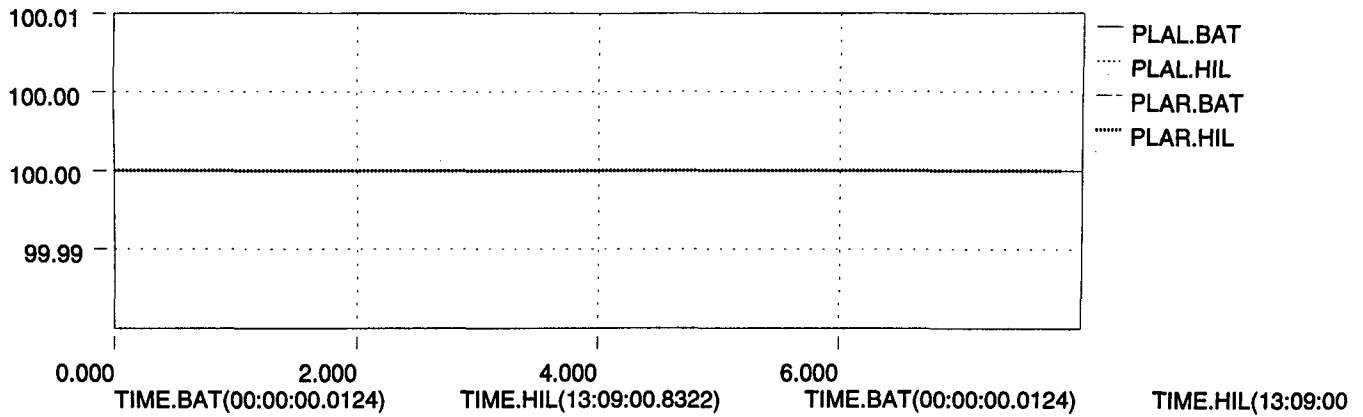
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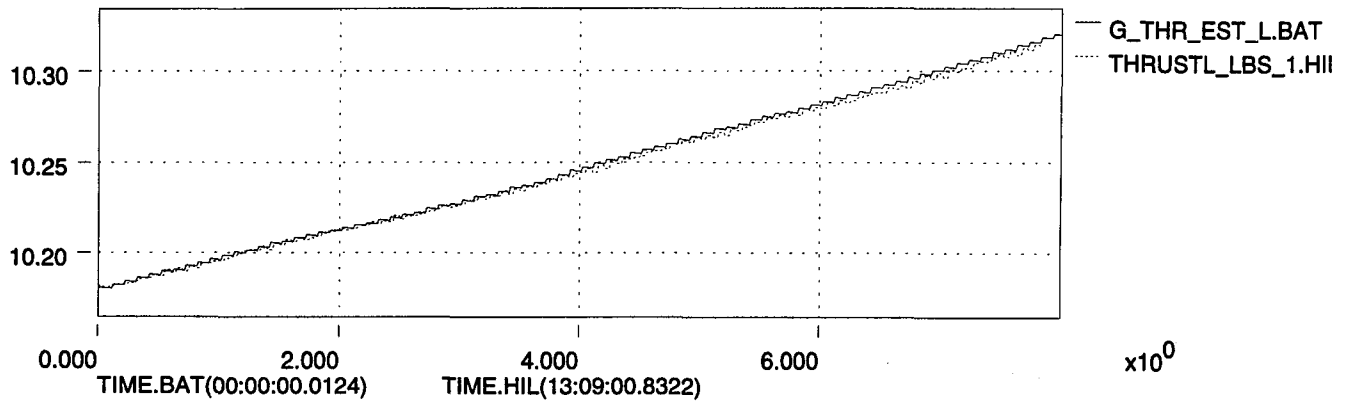
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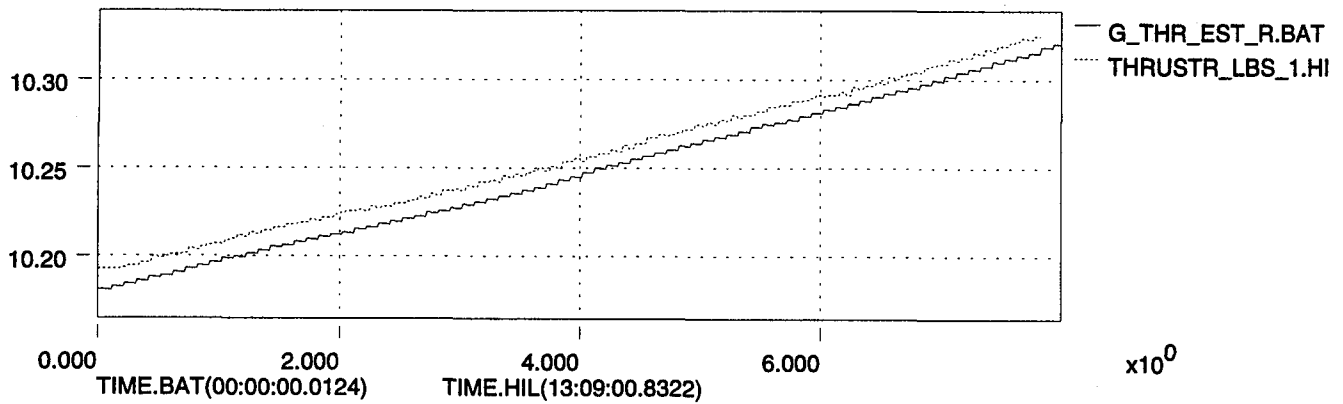


$\times 10^3$

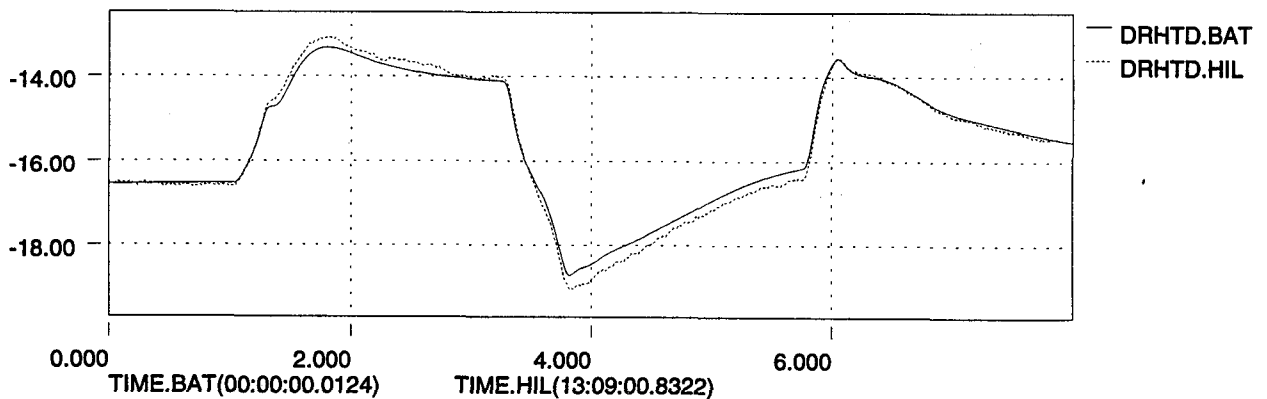


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$\times 10^3$

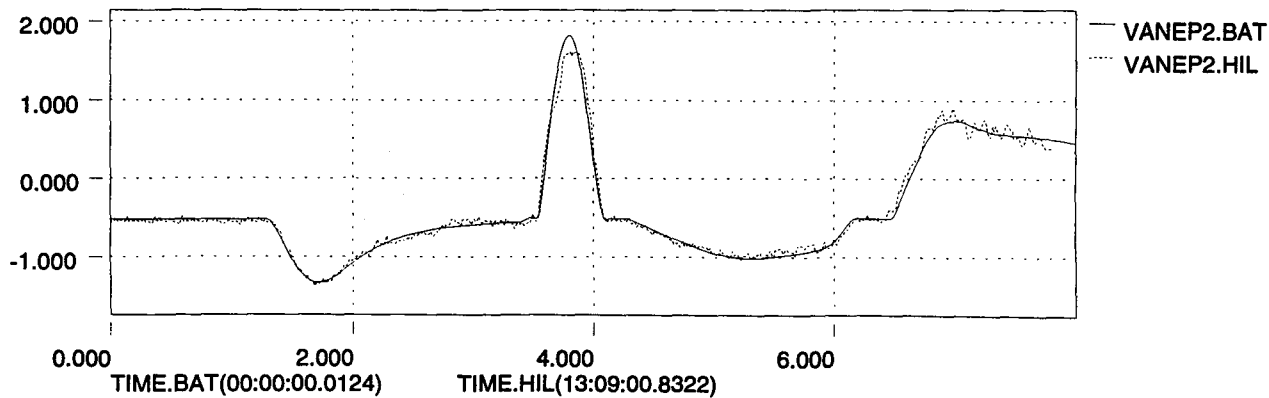
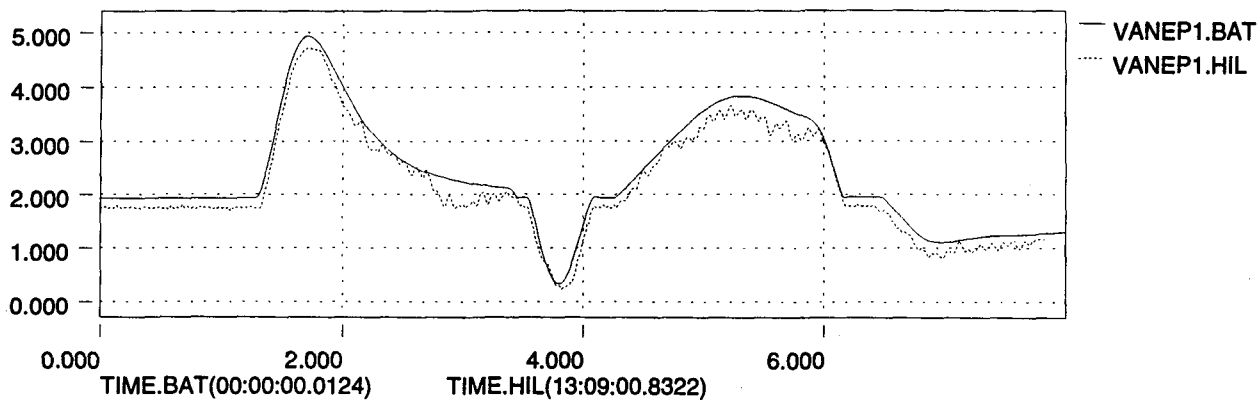
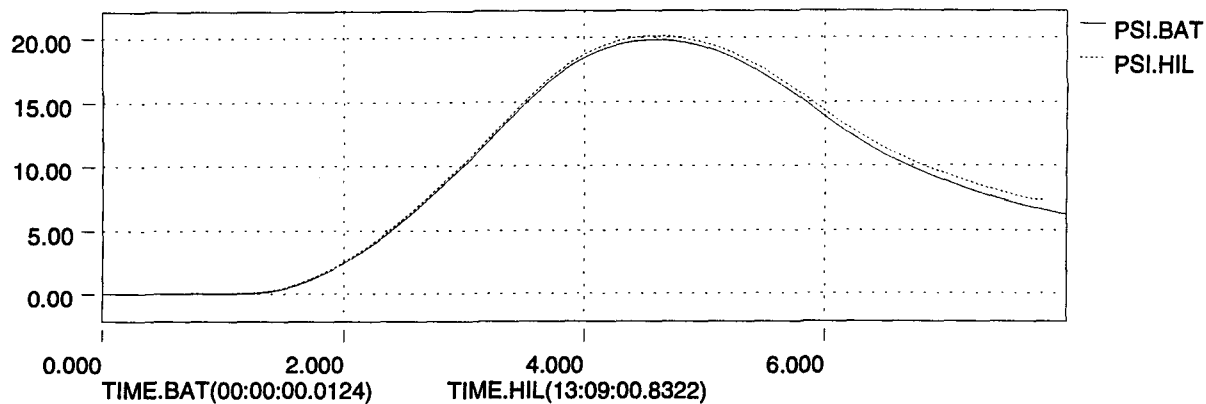
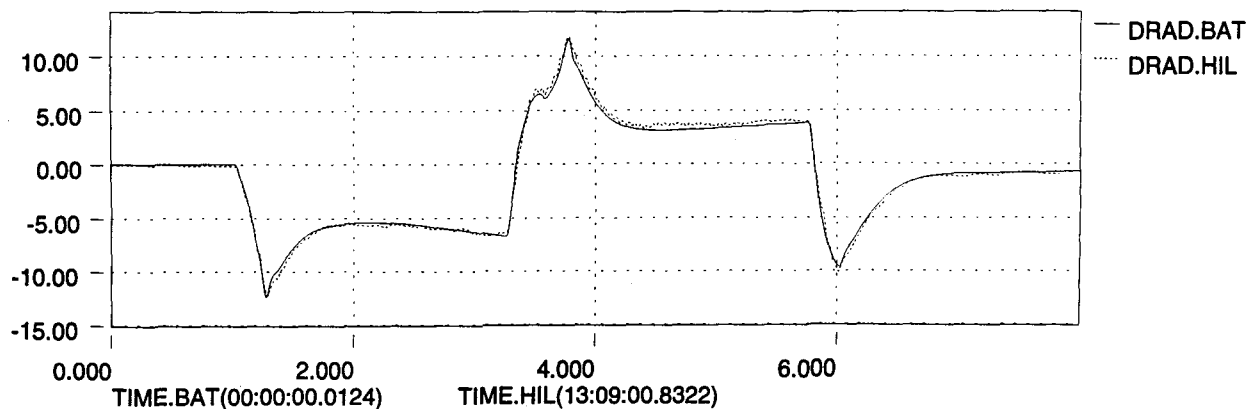


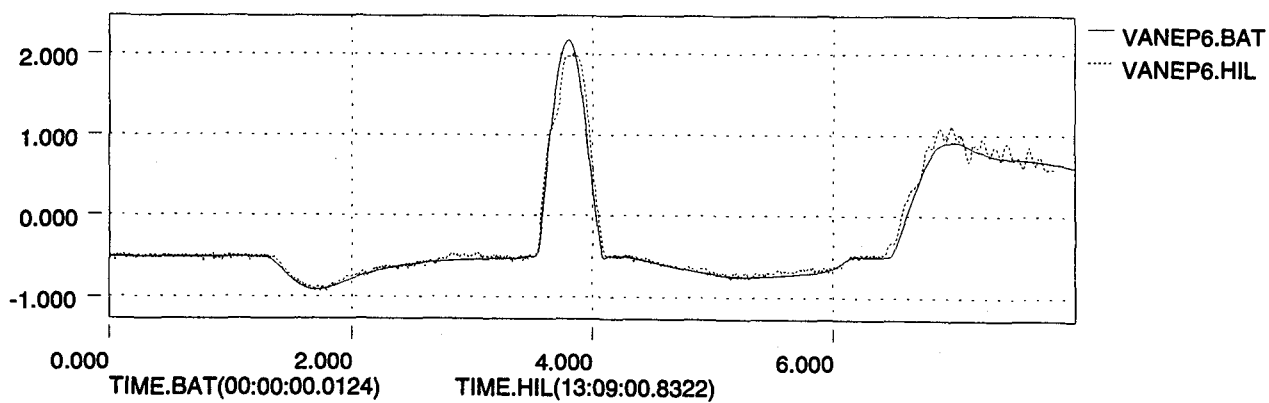
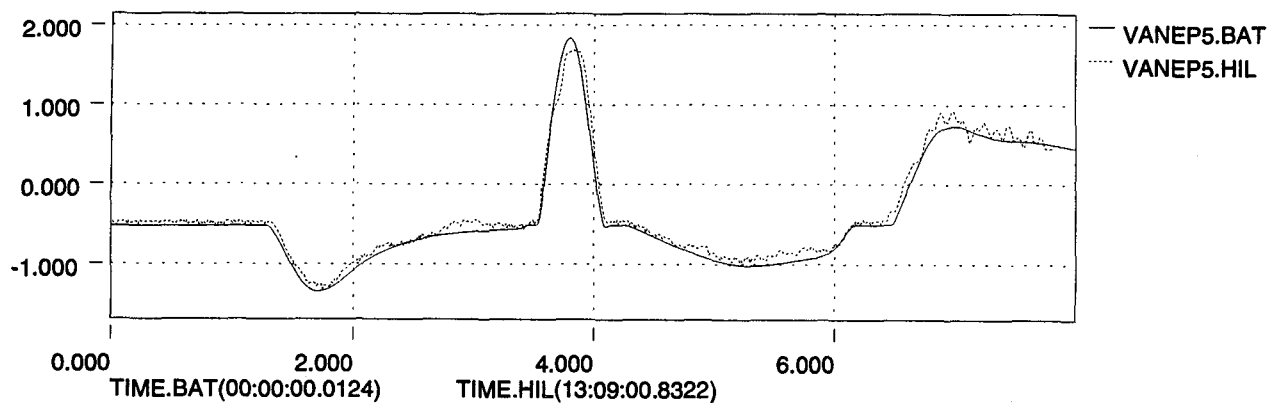
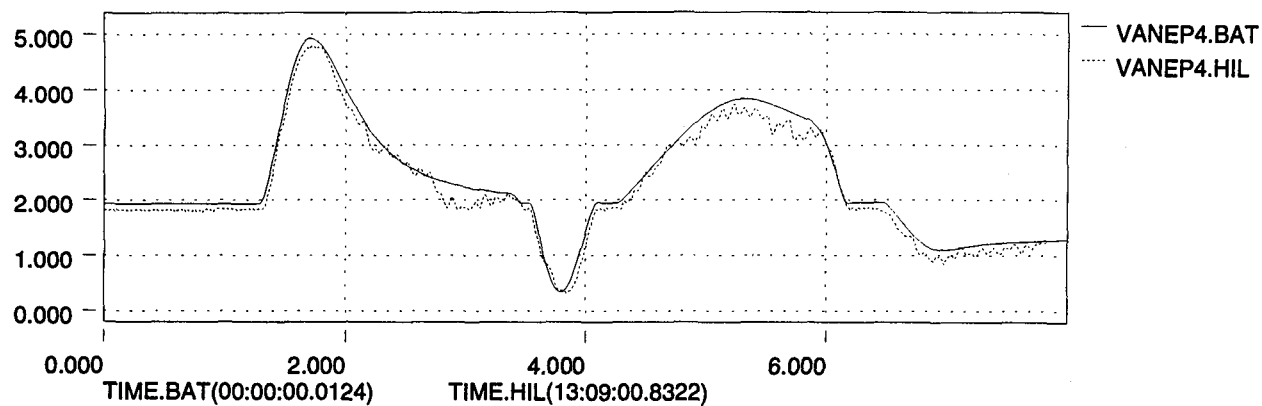
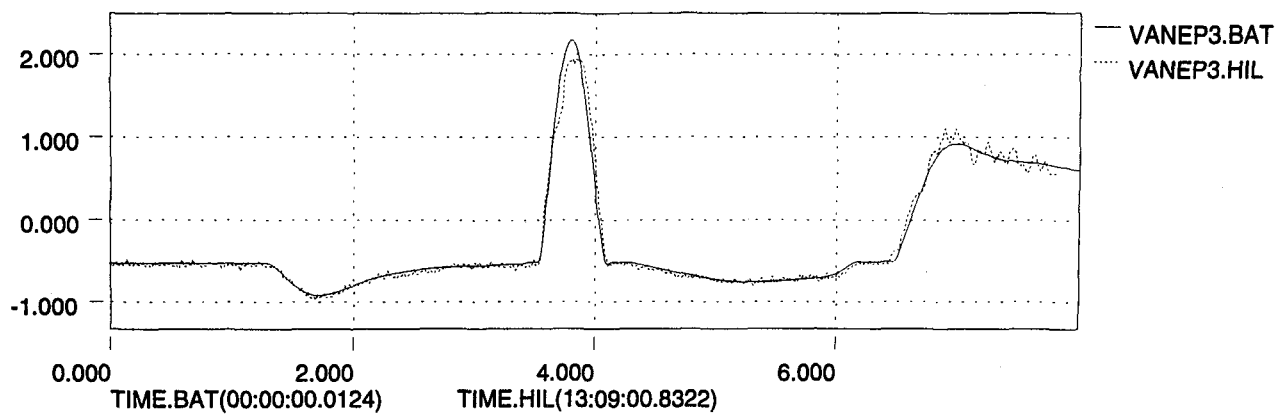
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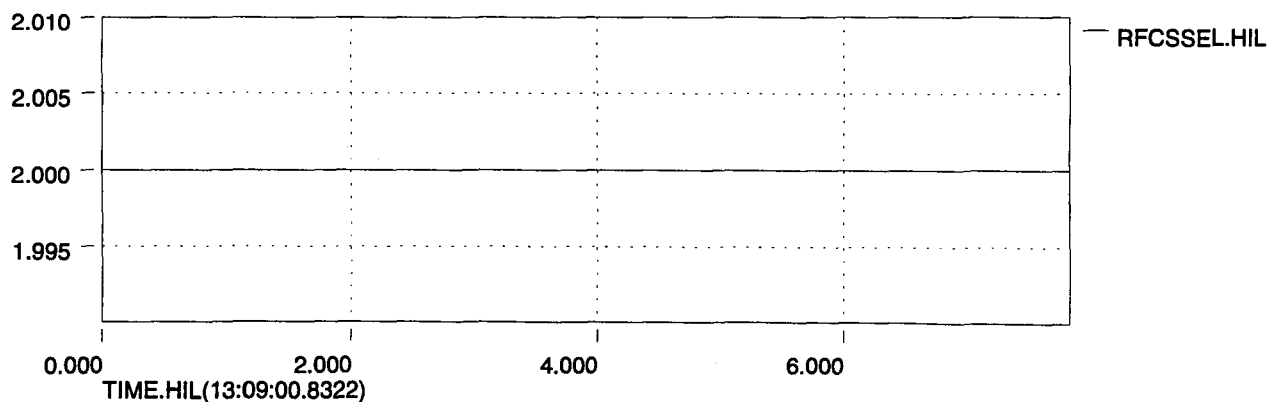
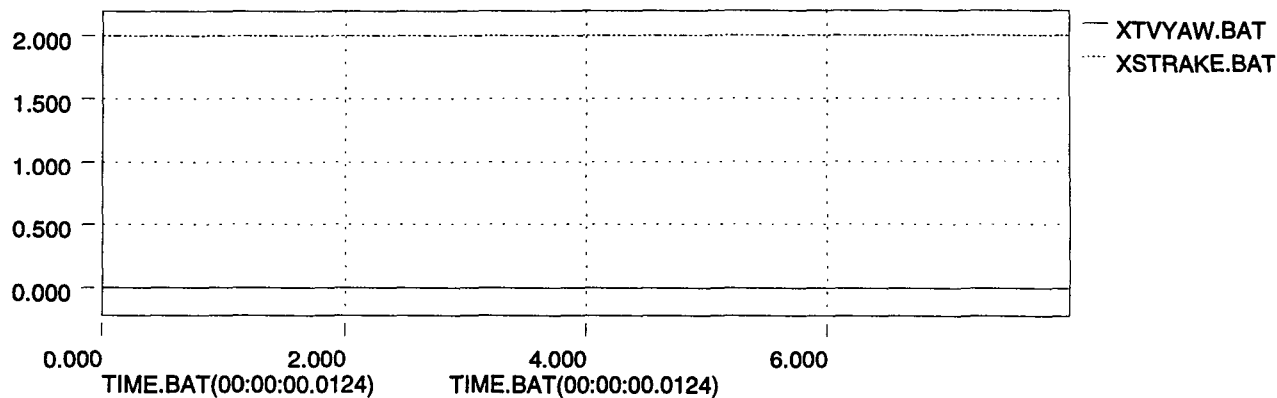
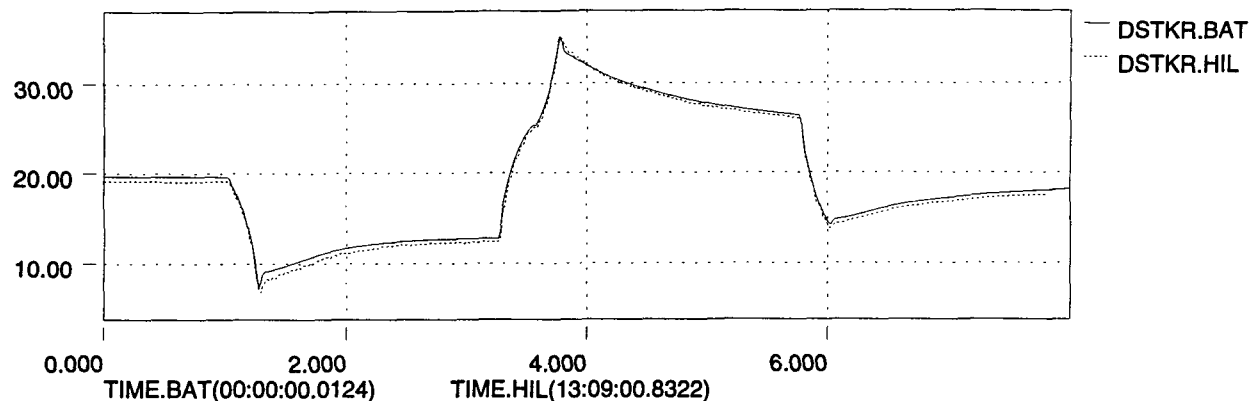
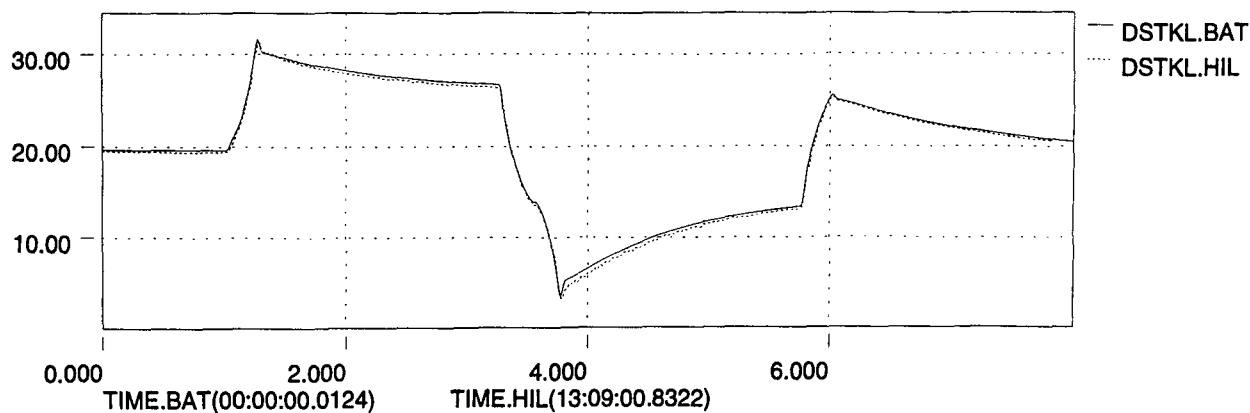
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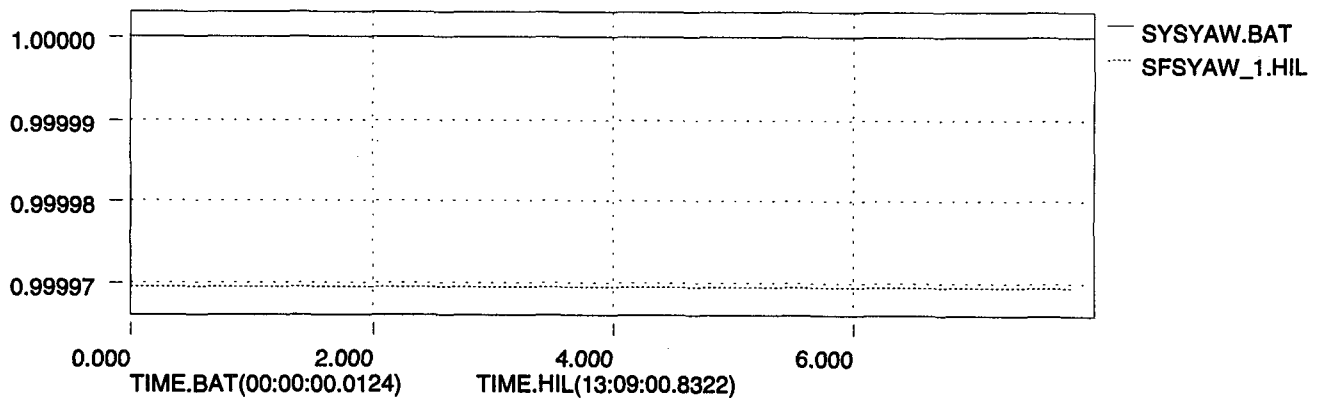
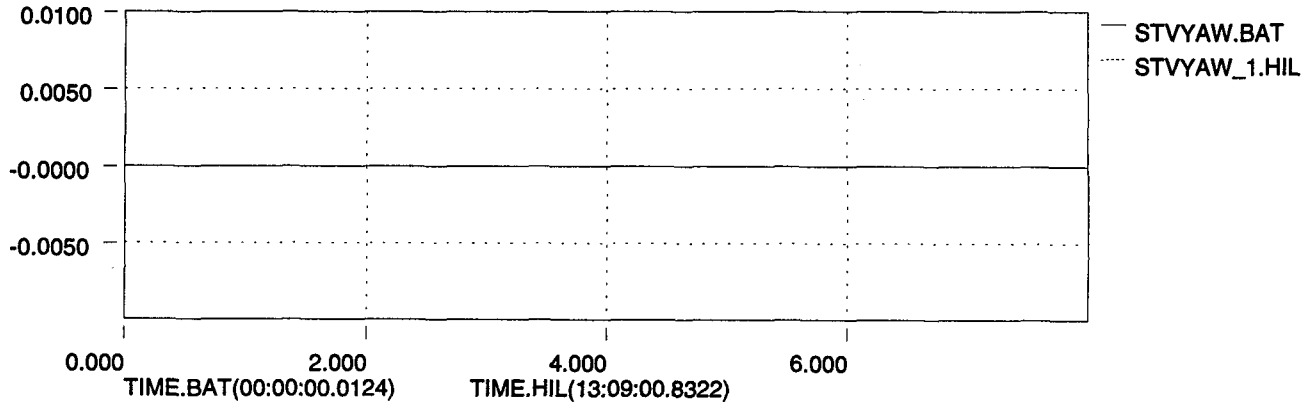
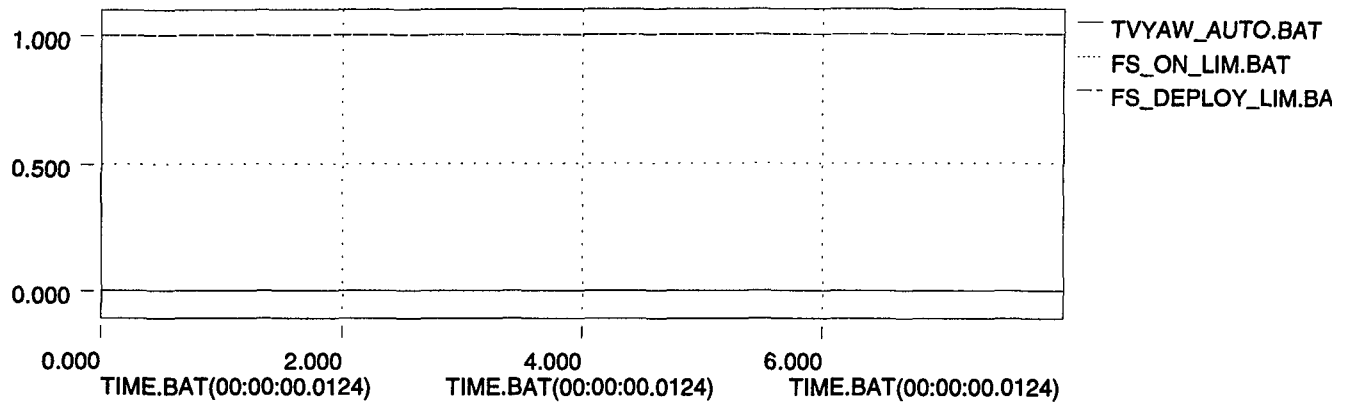
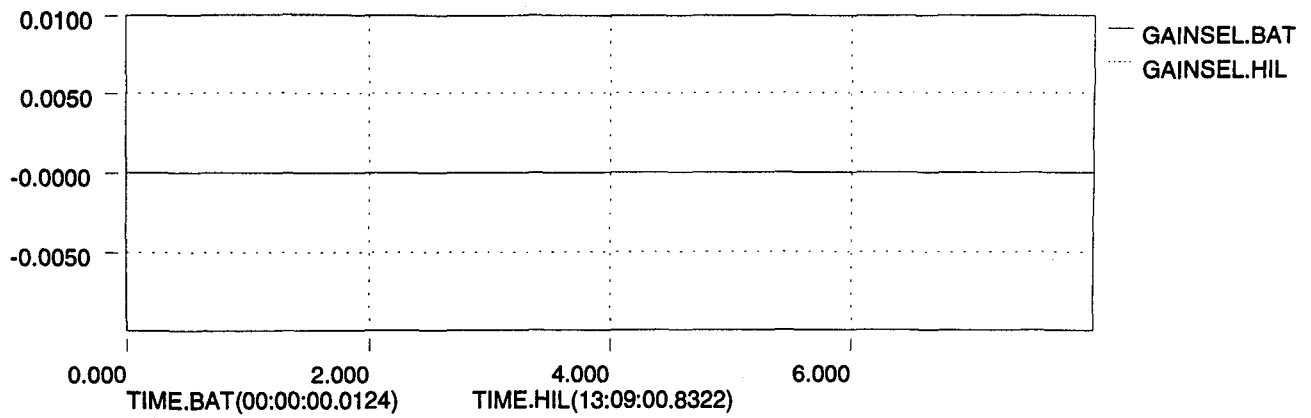
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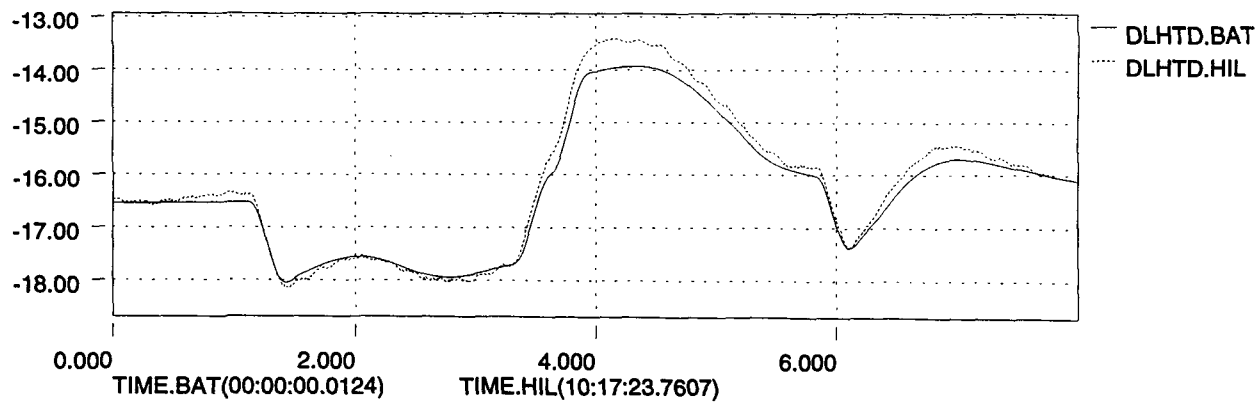
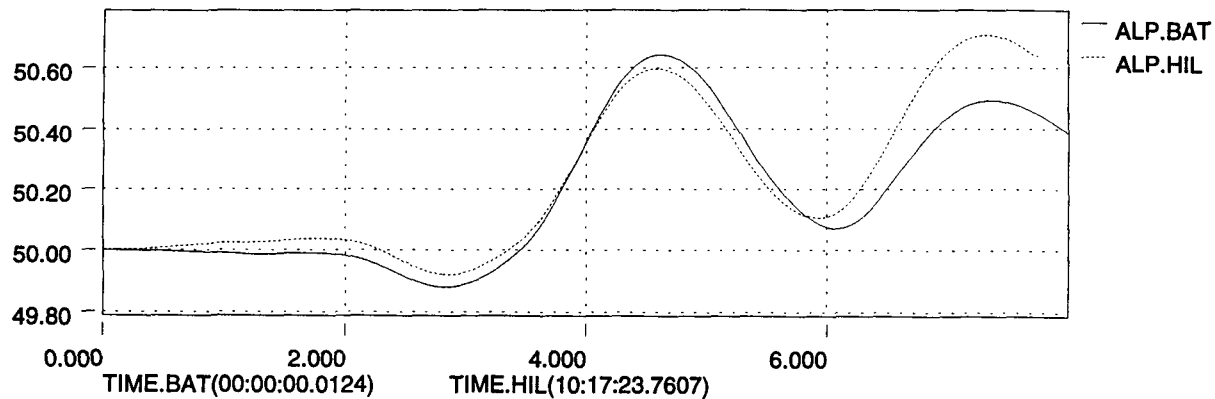
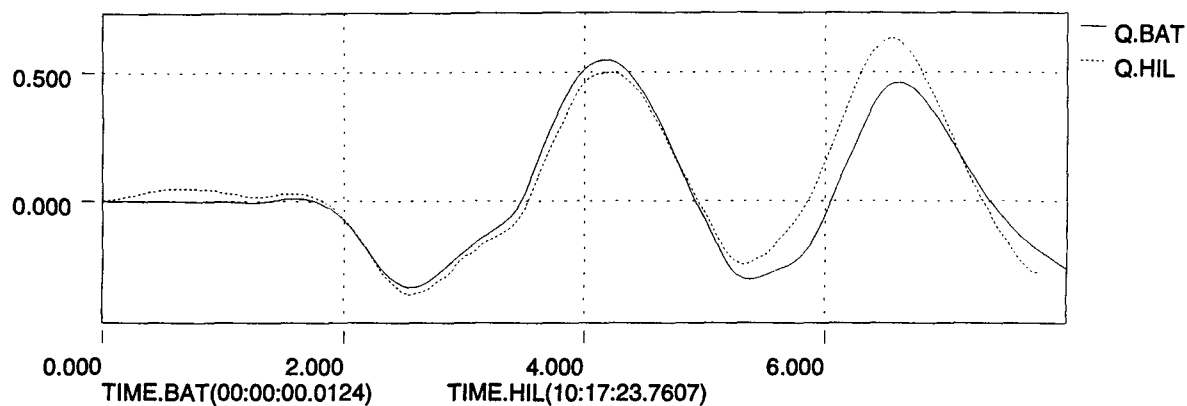
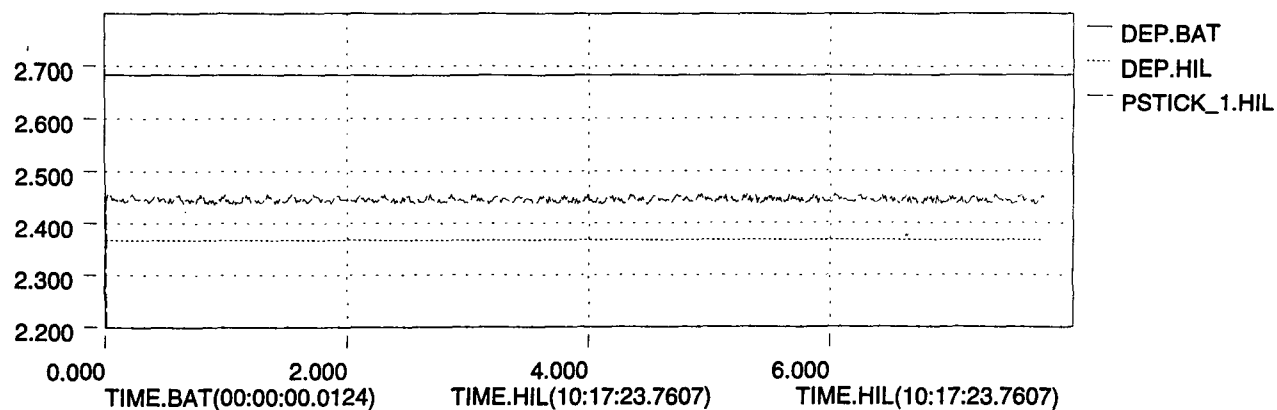


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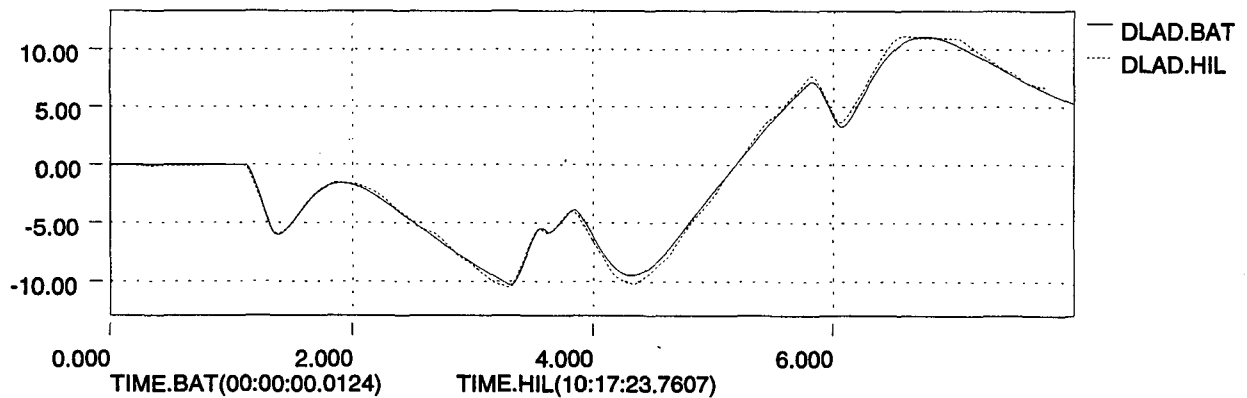
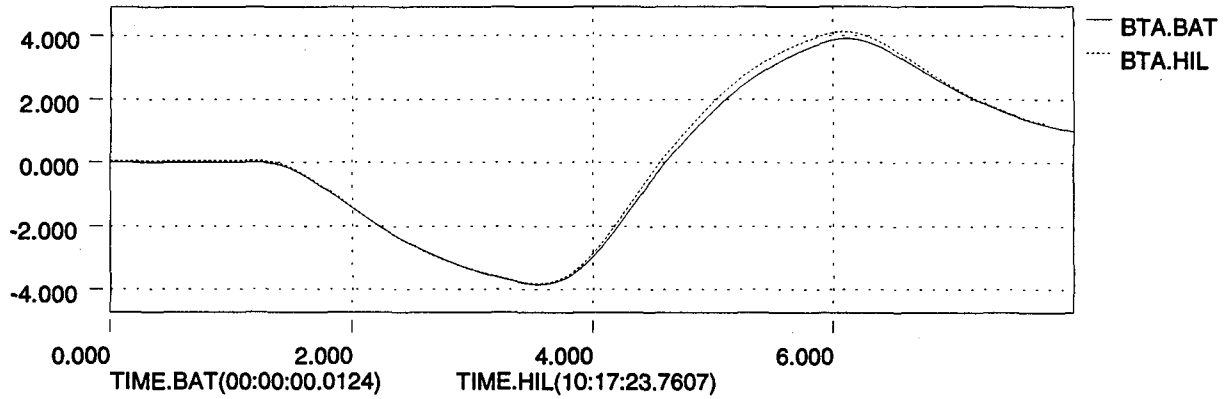
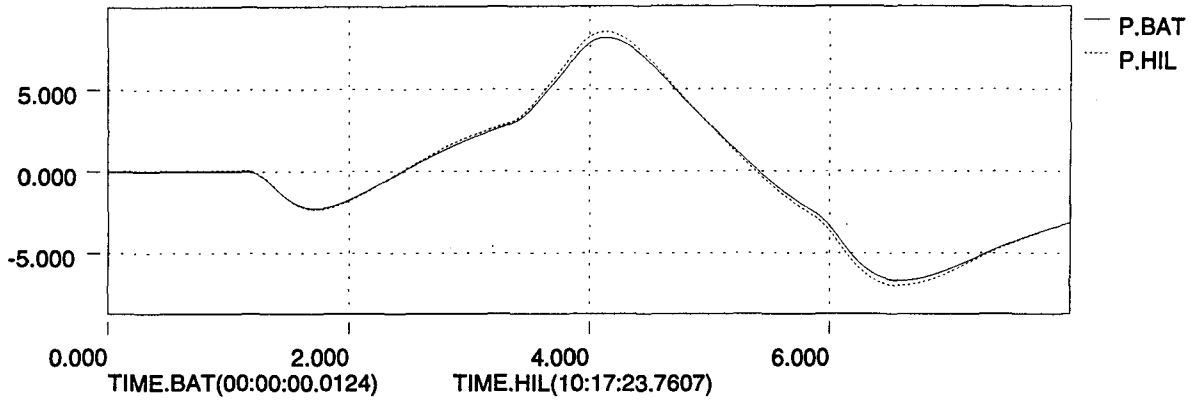
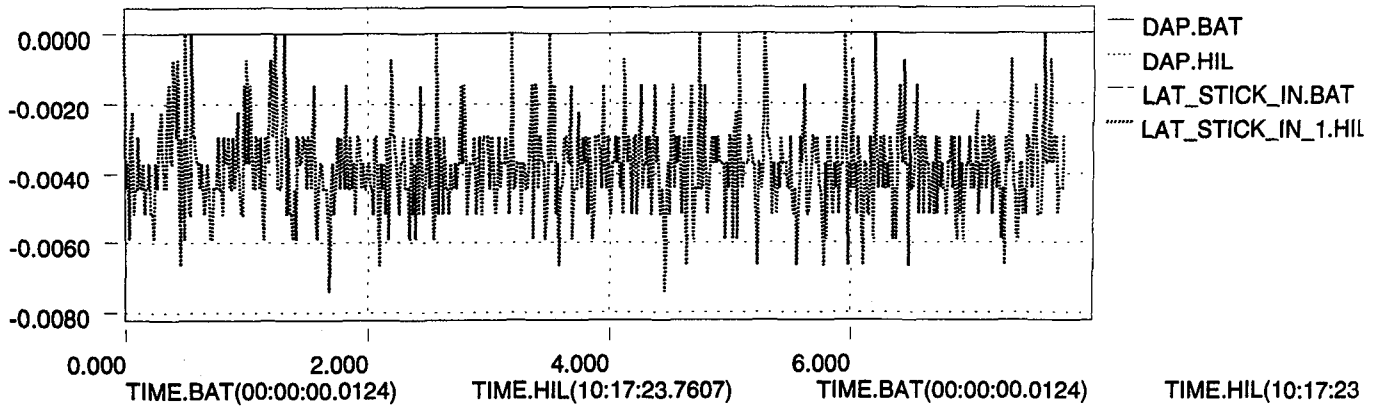
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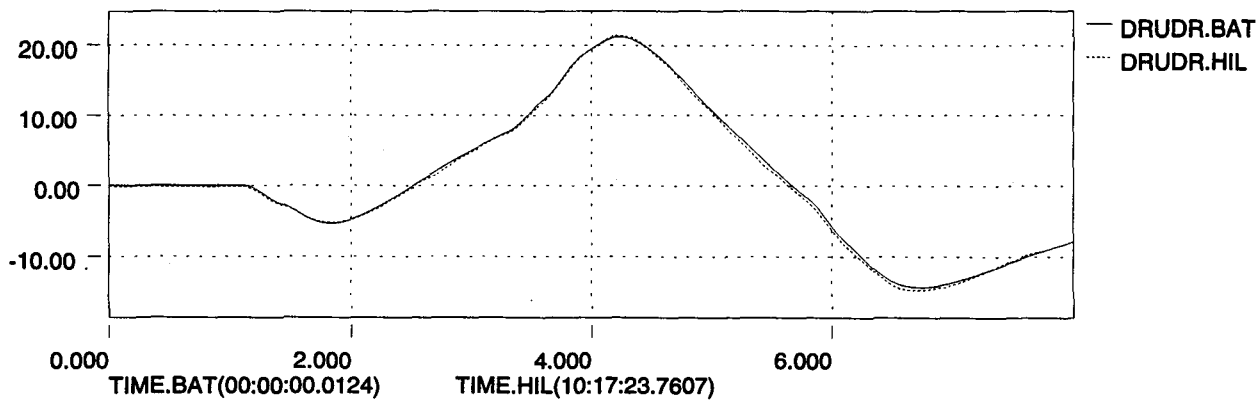
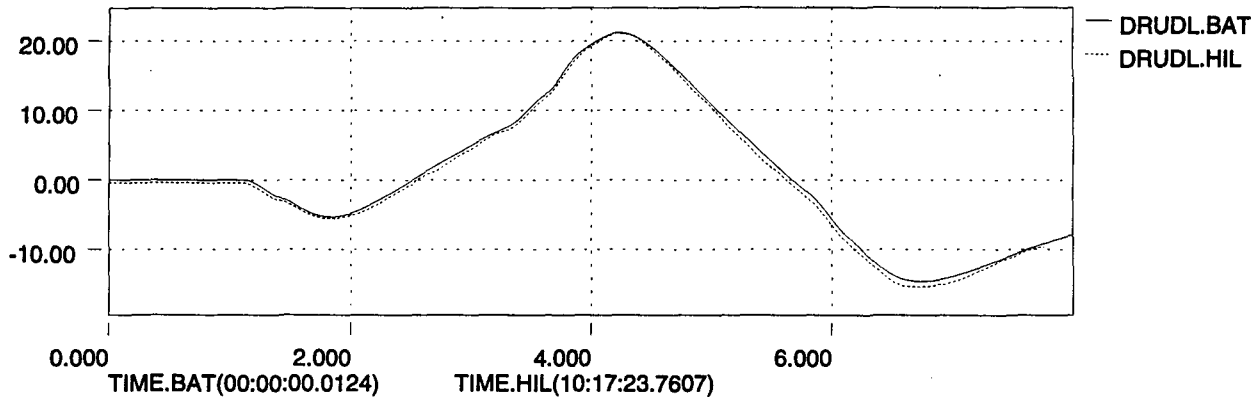
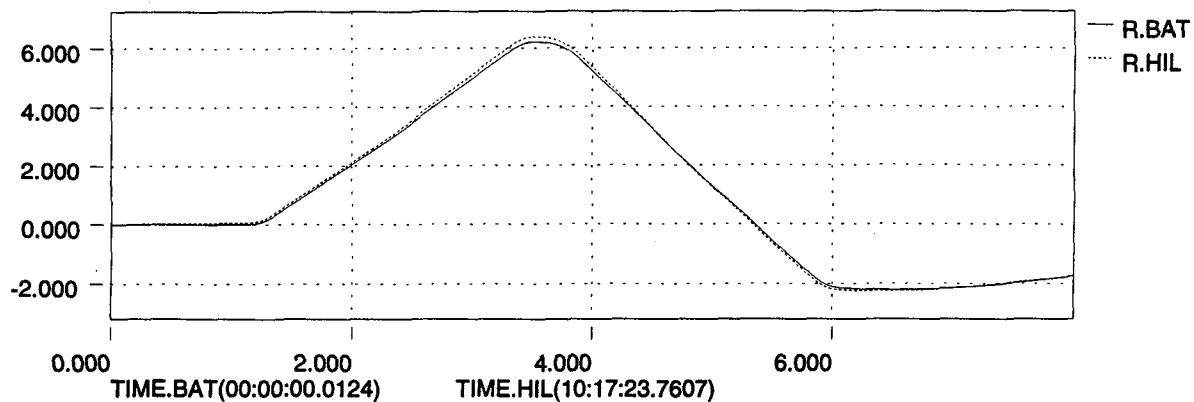
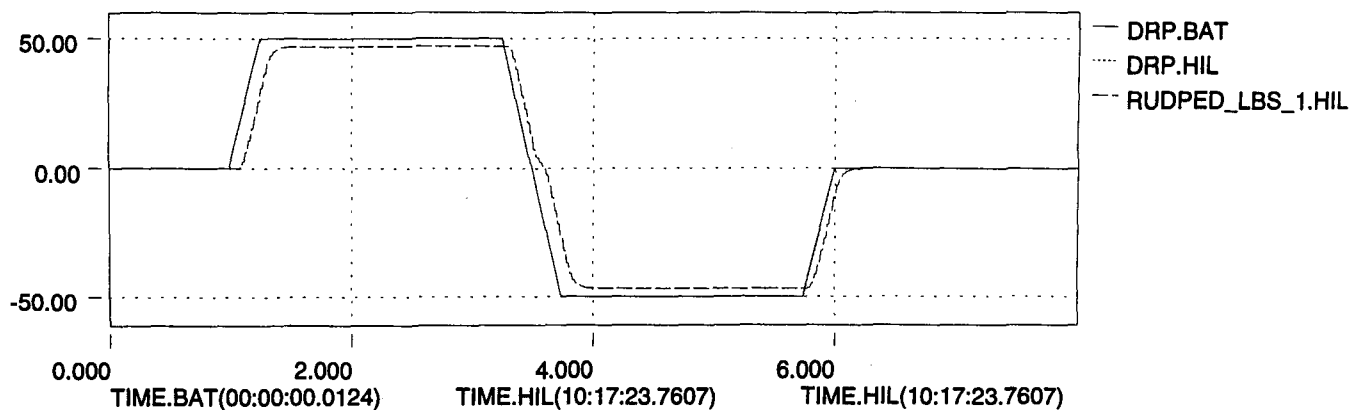


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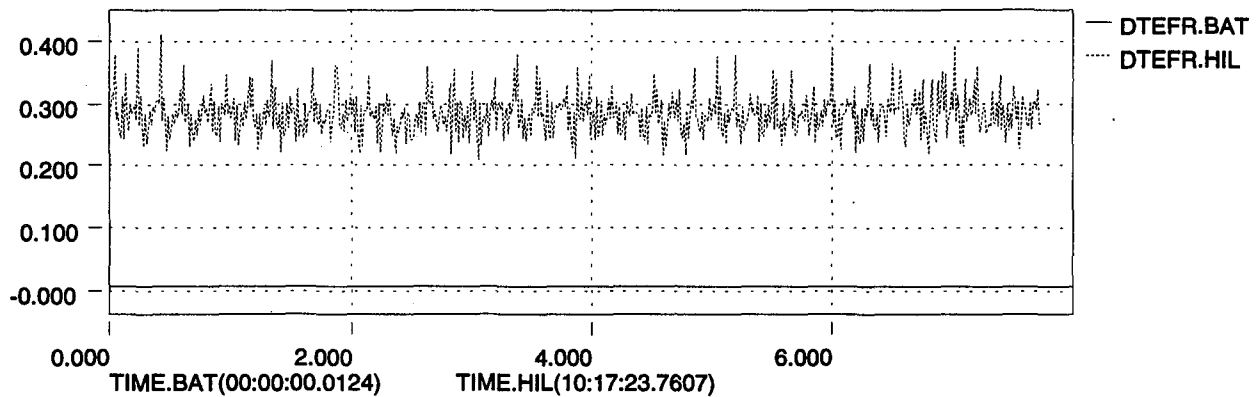
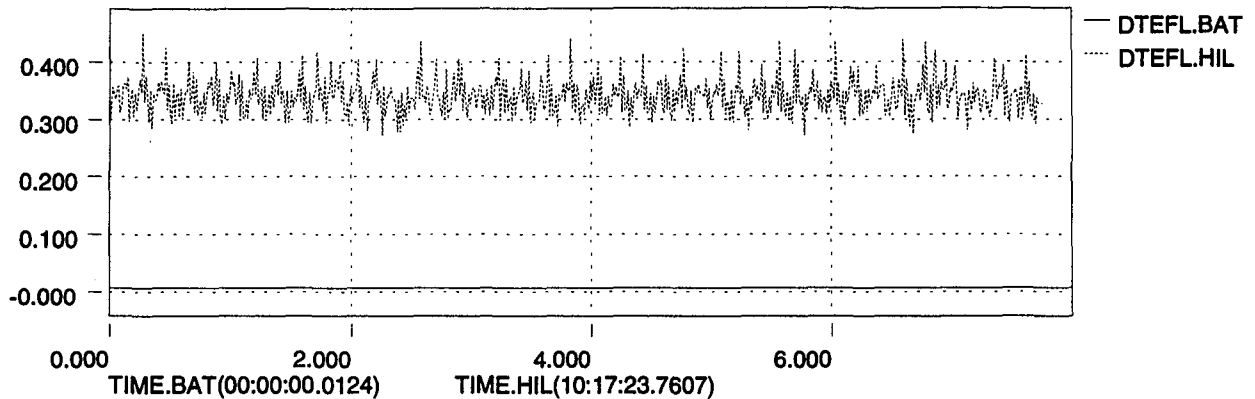
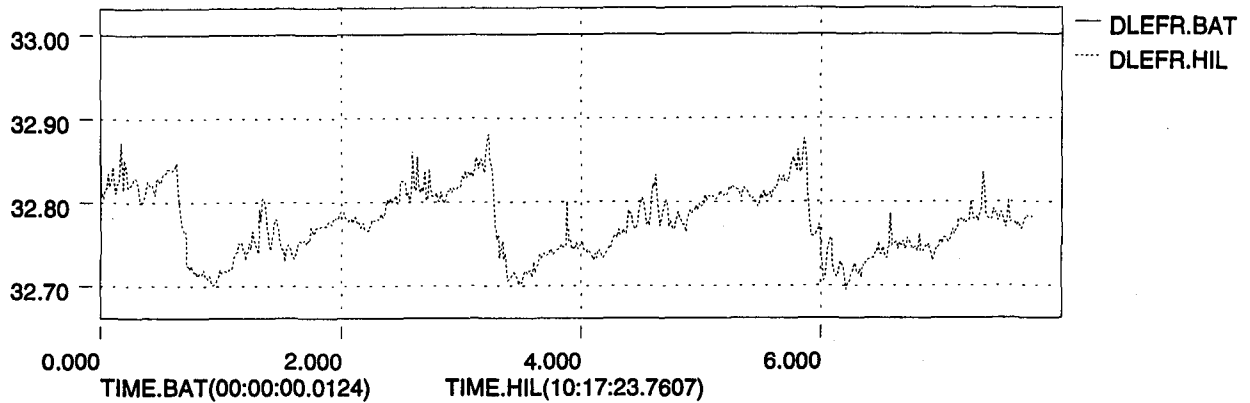
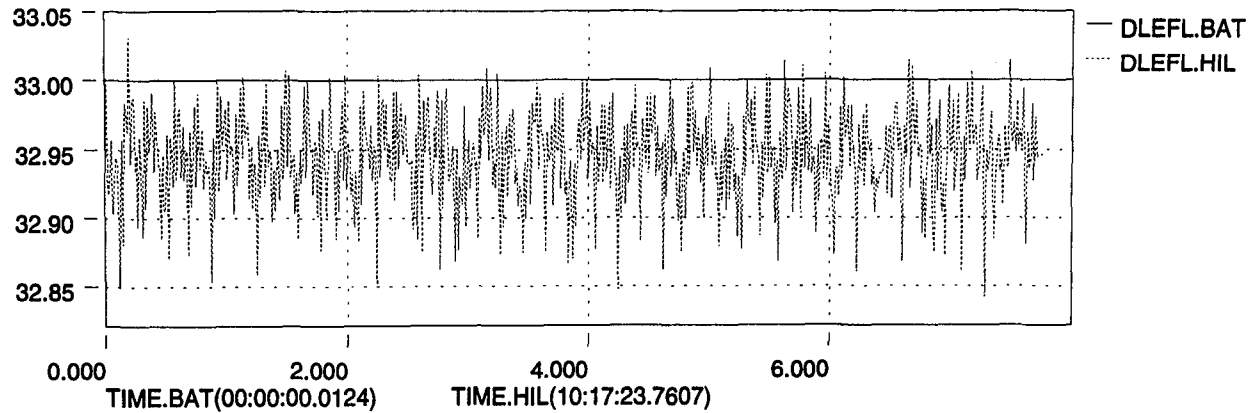
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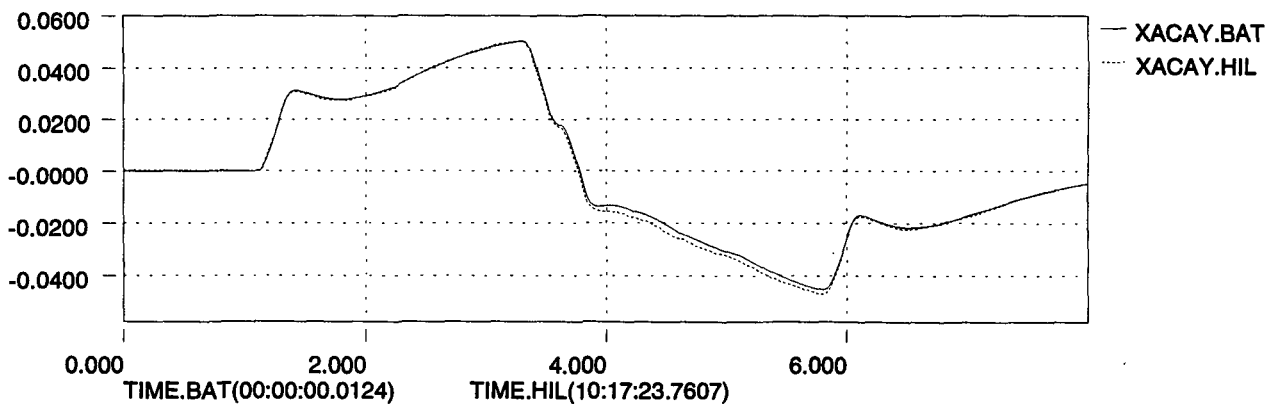
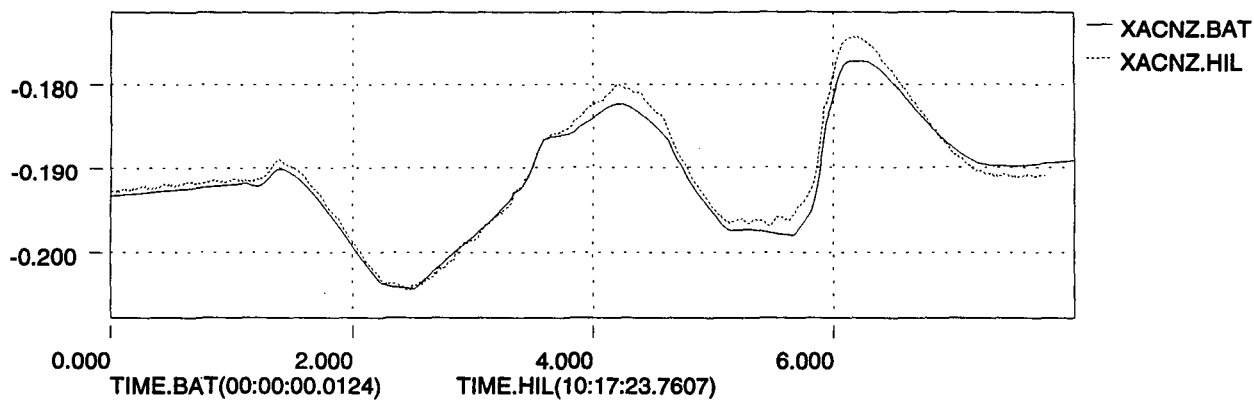
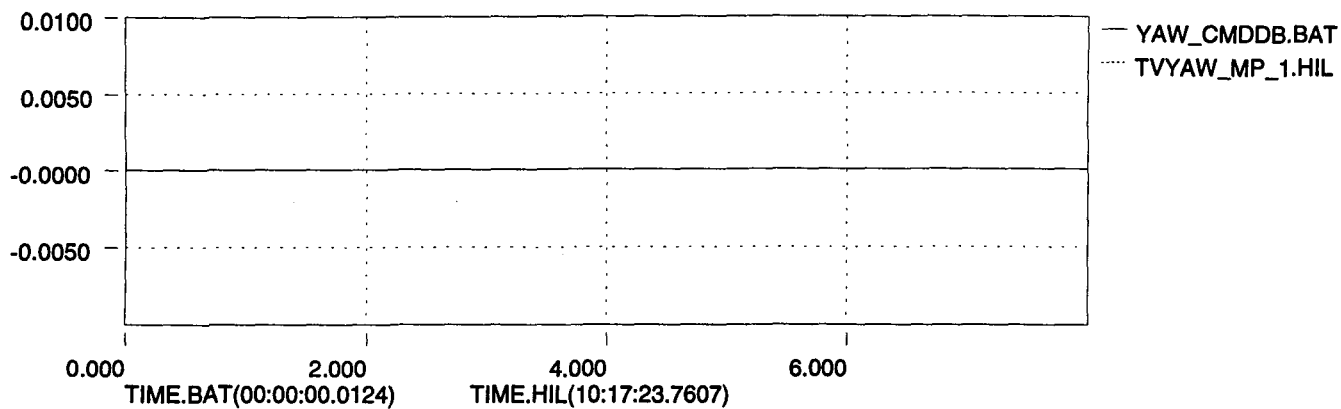
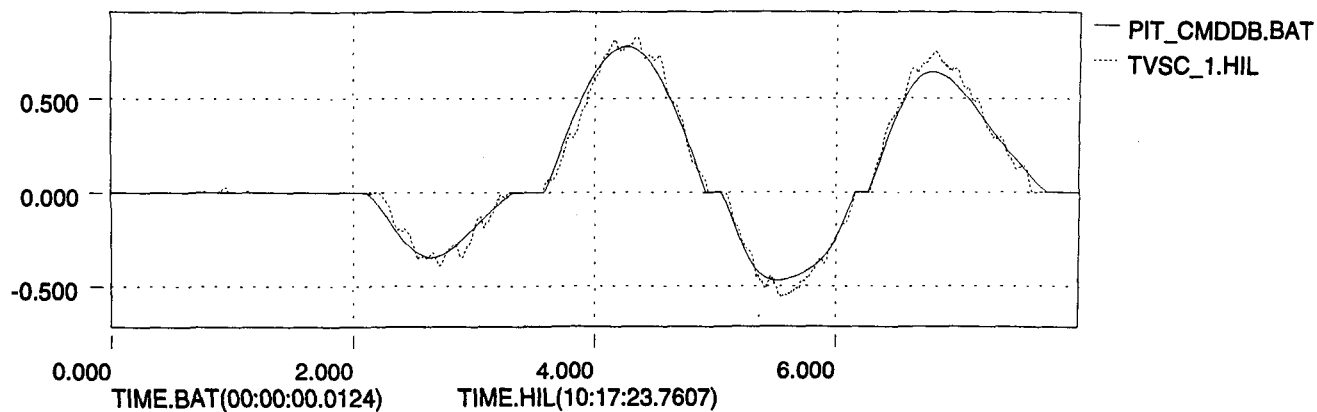


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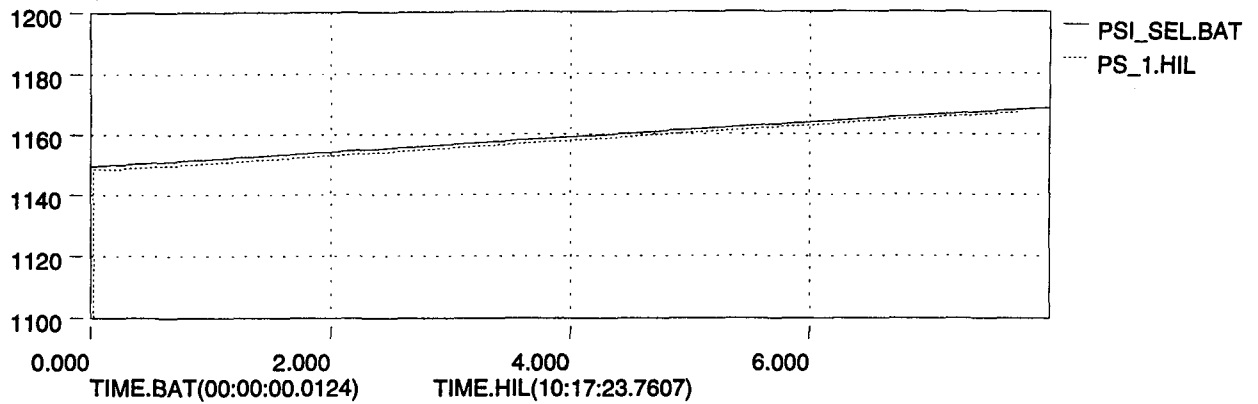
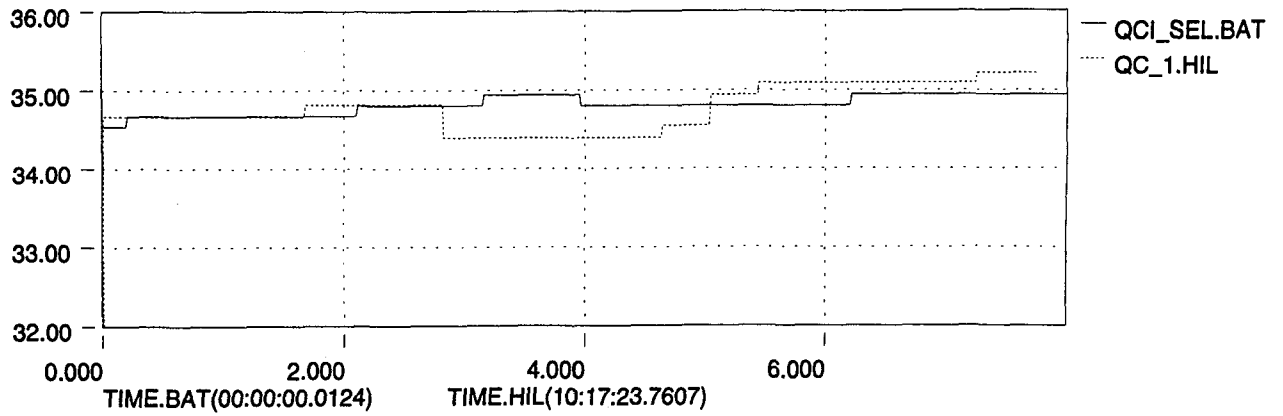
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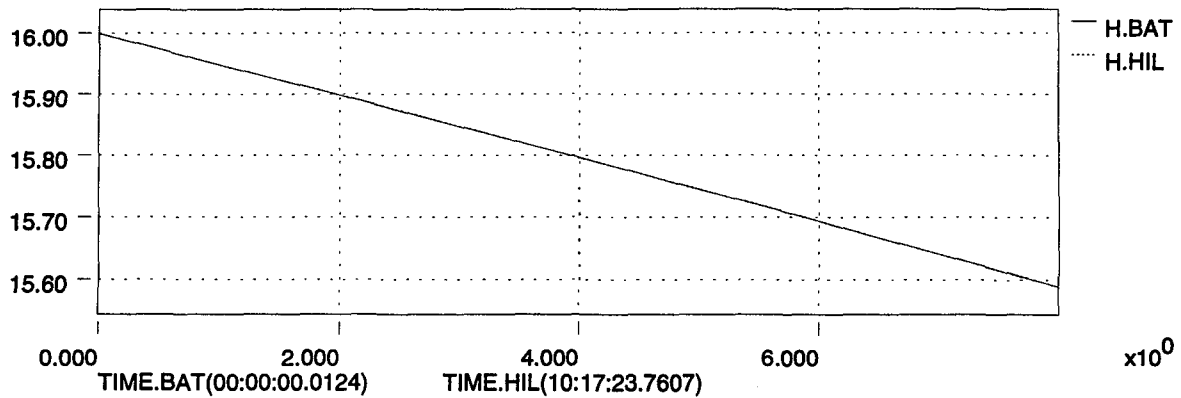
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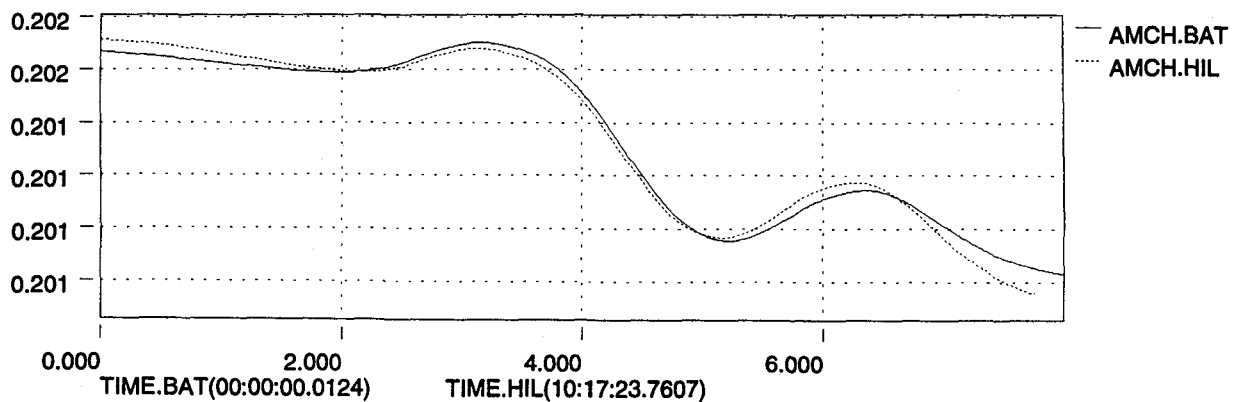
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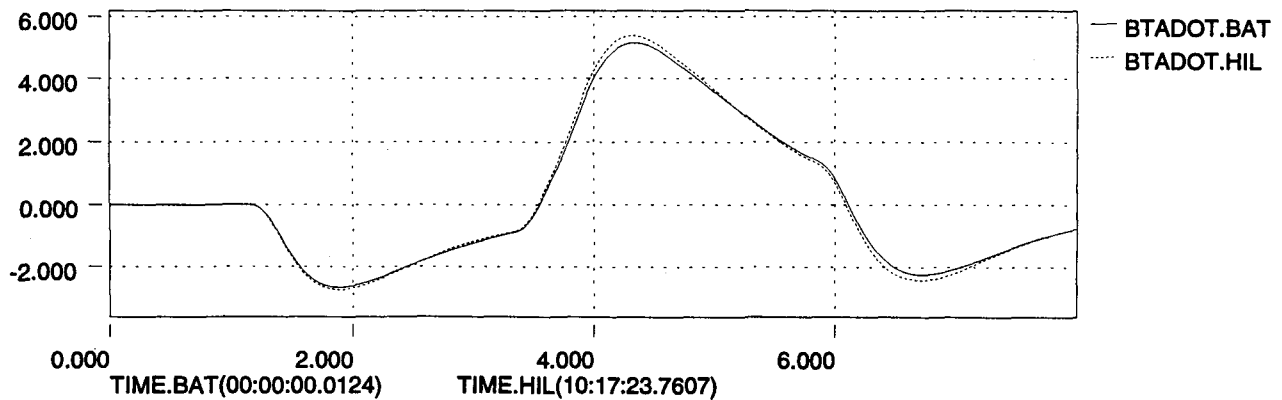
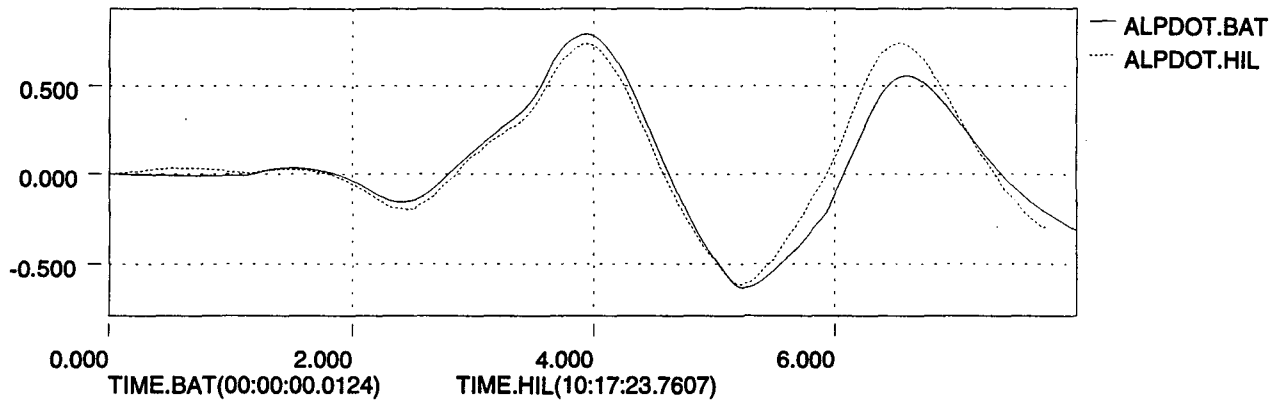
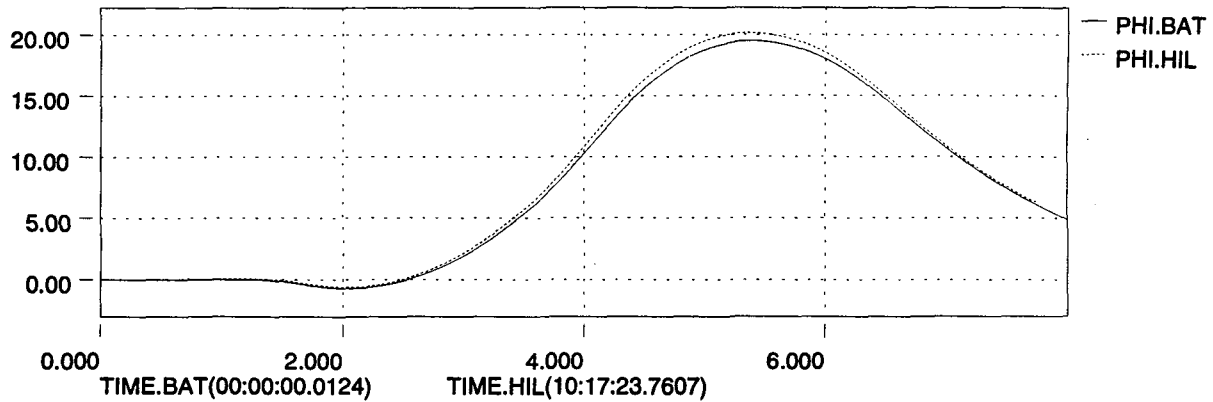
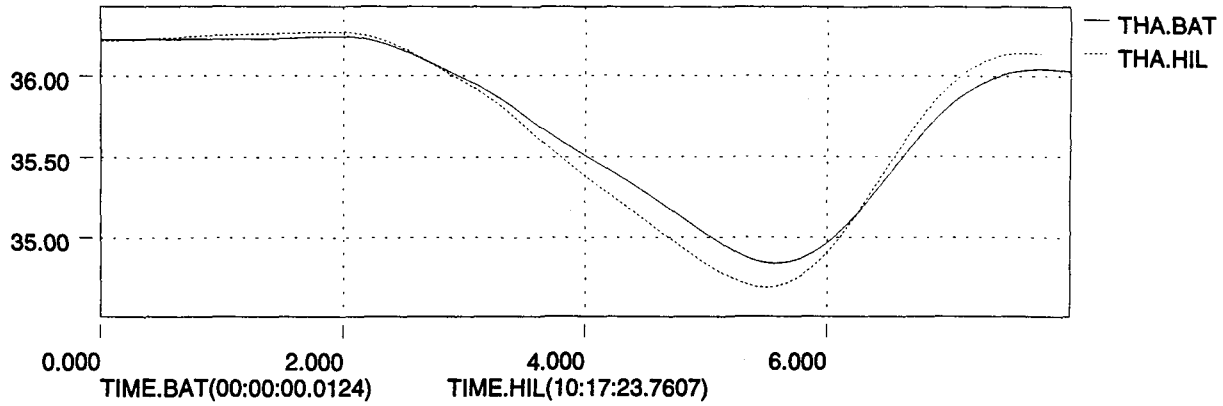


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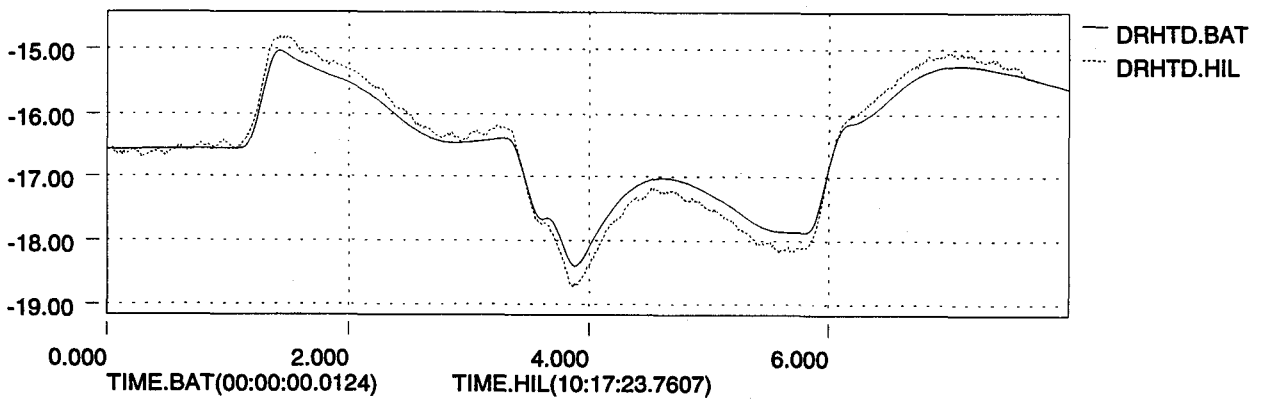
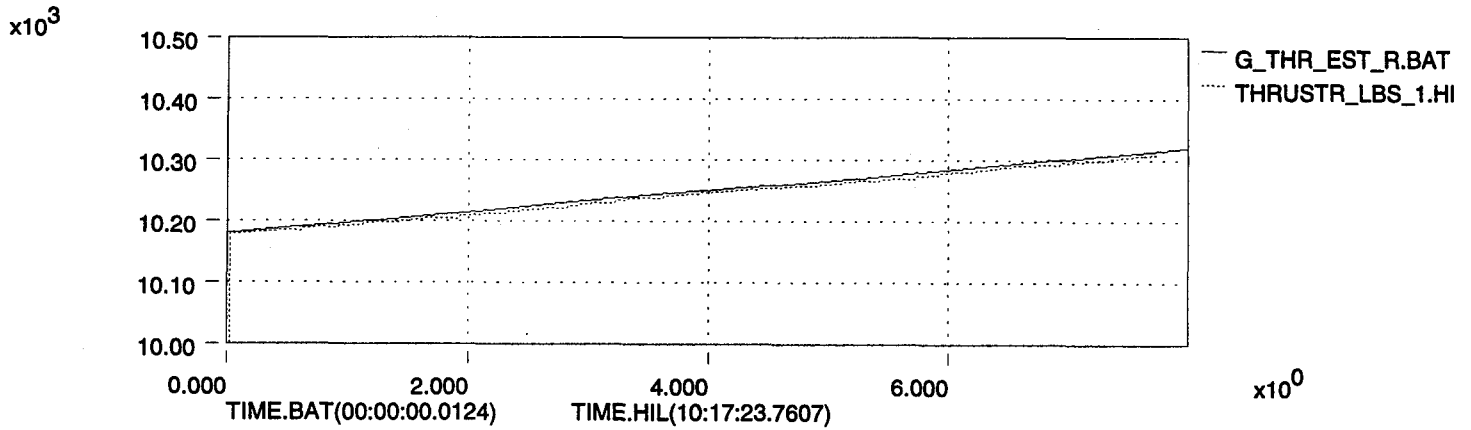
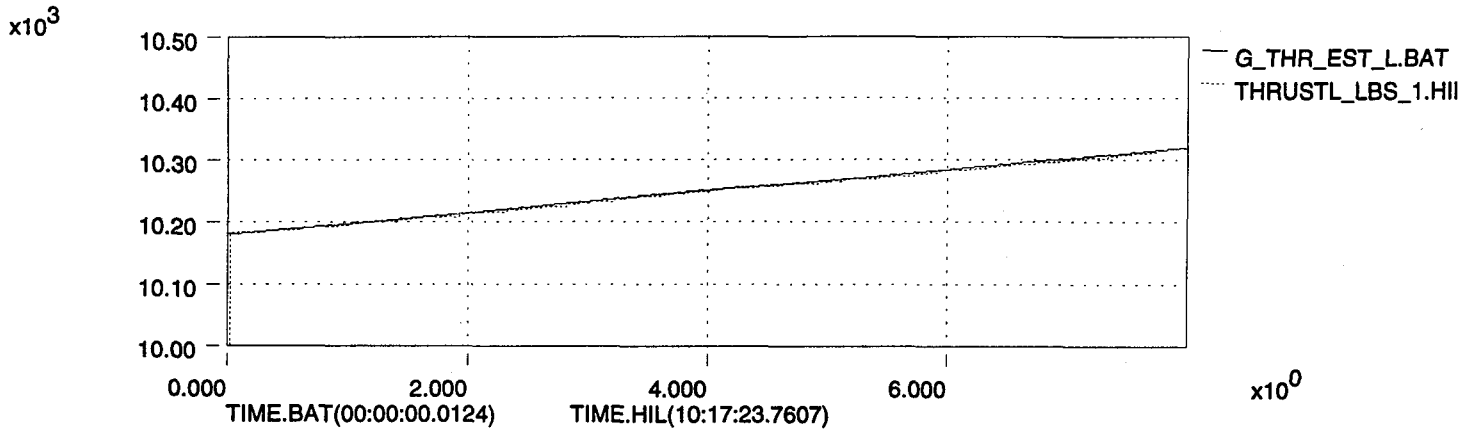
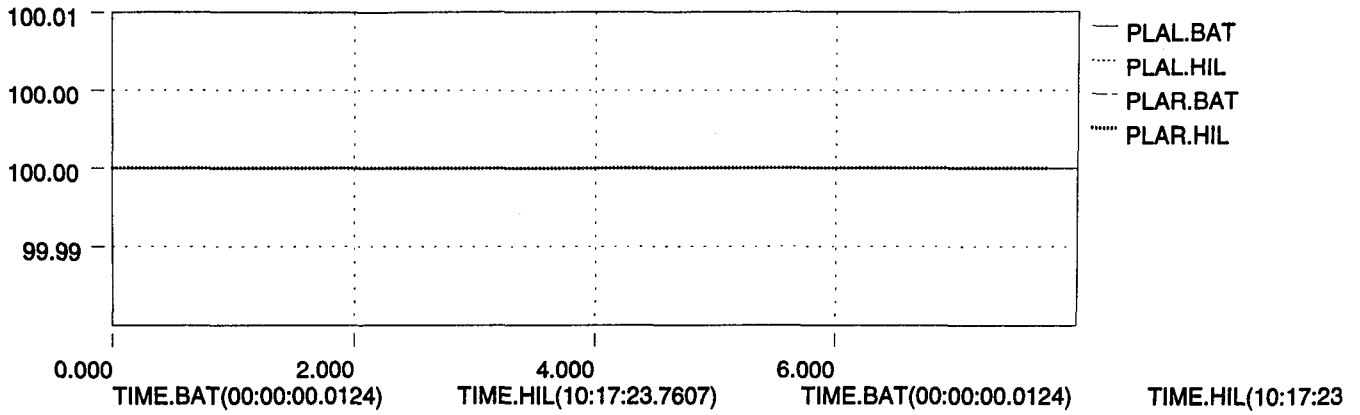


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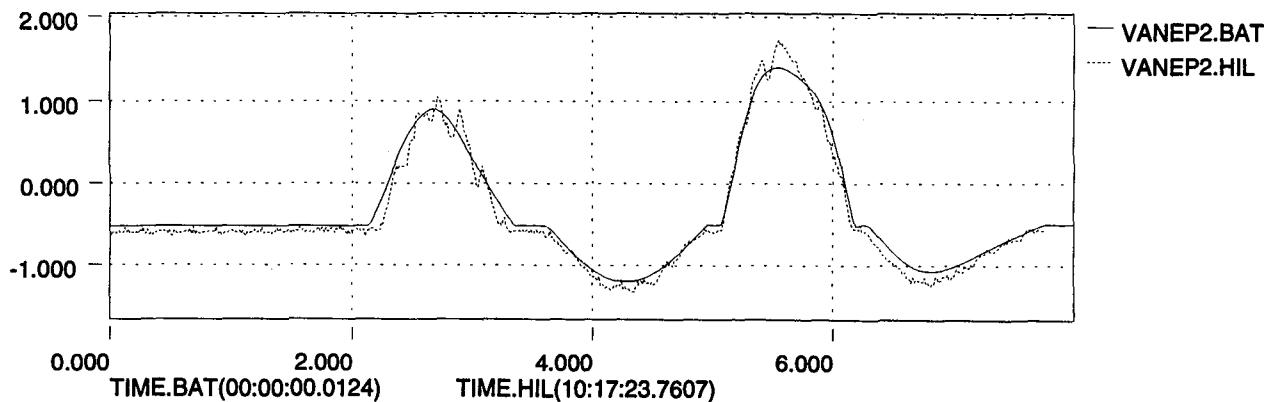
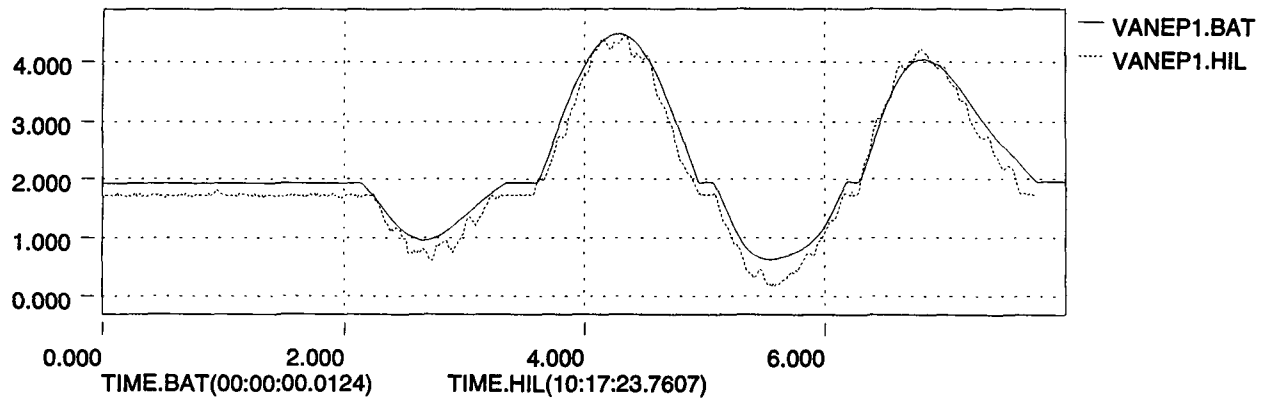
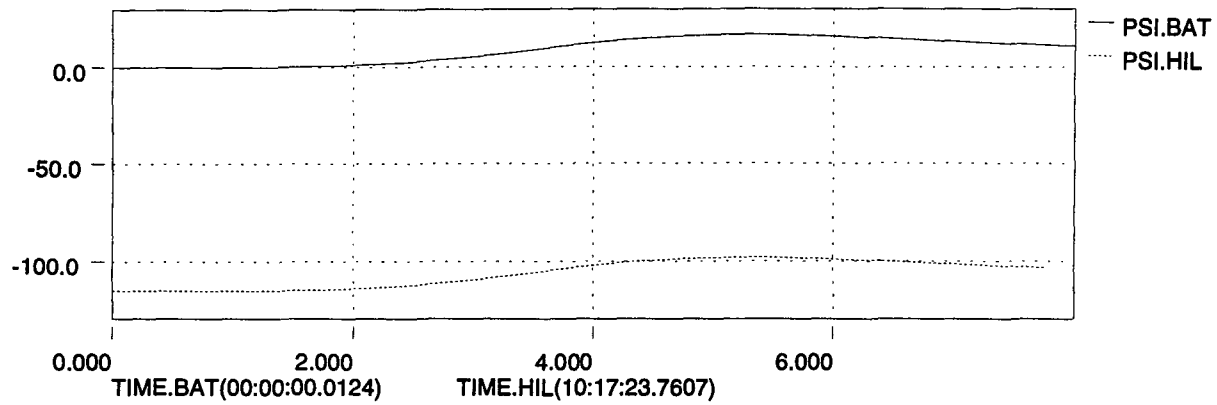
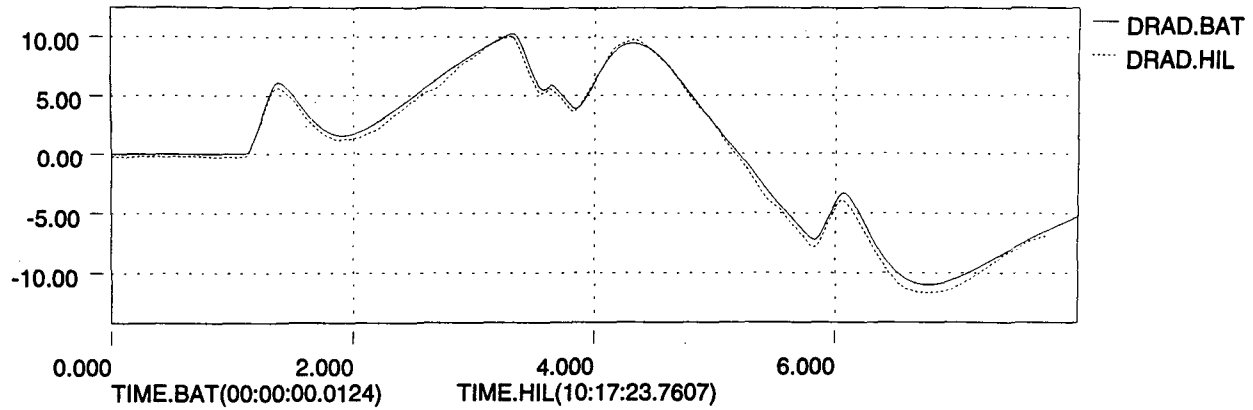




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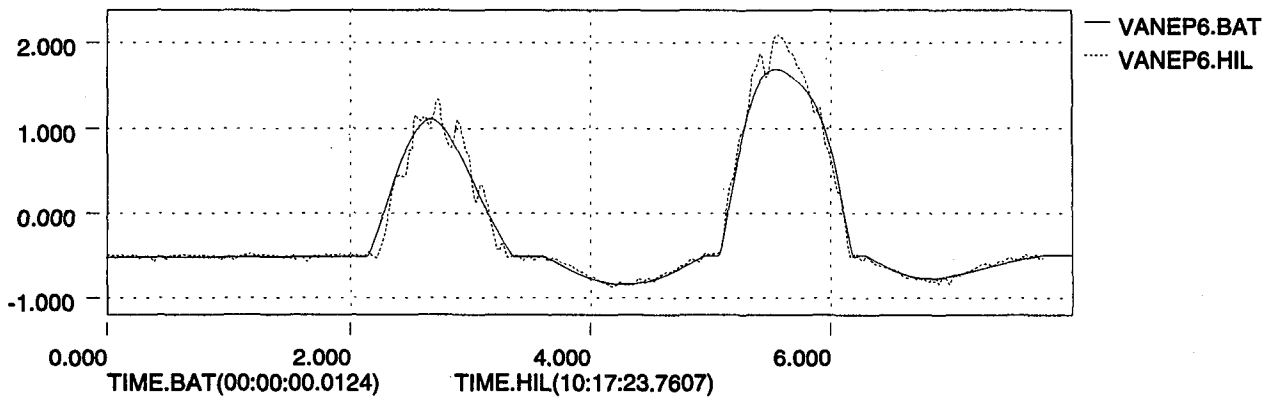
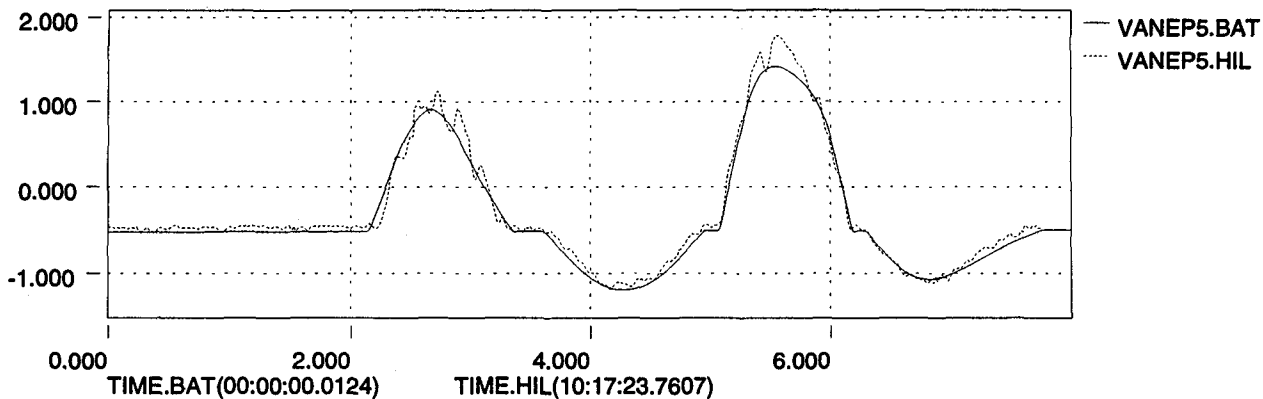
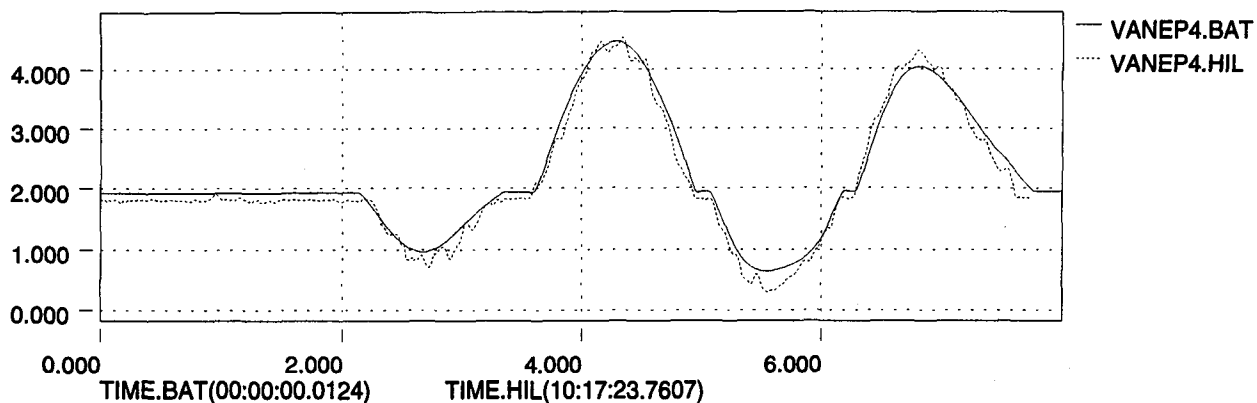
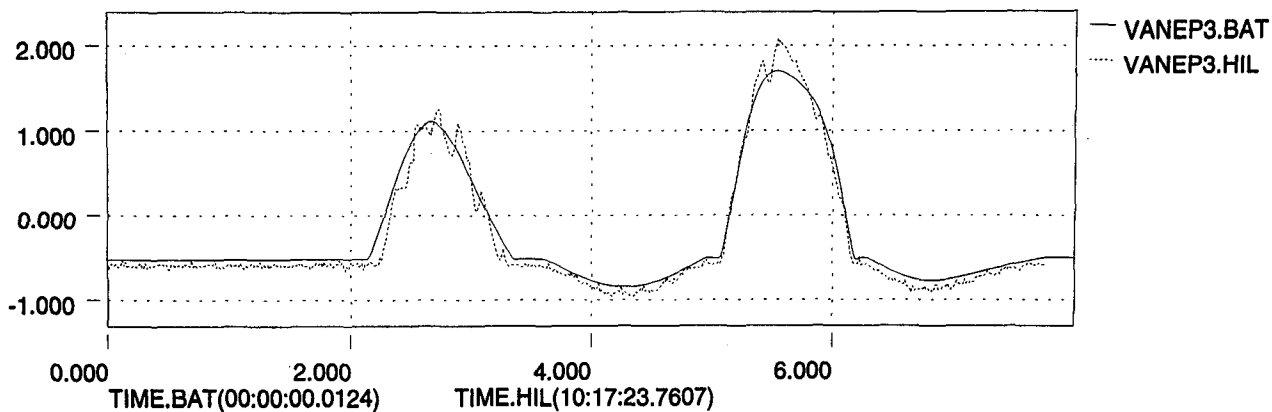


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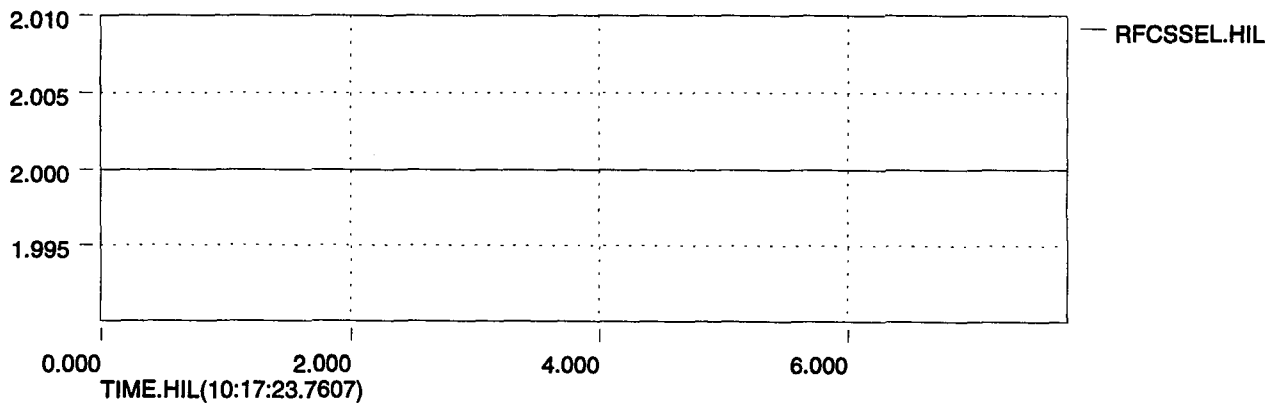
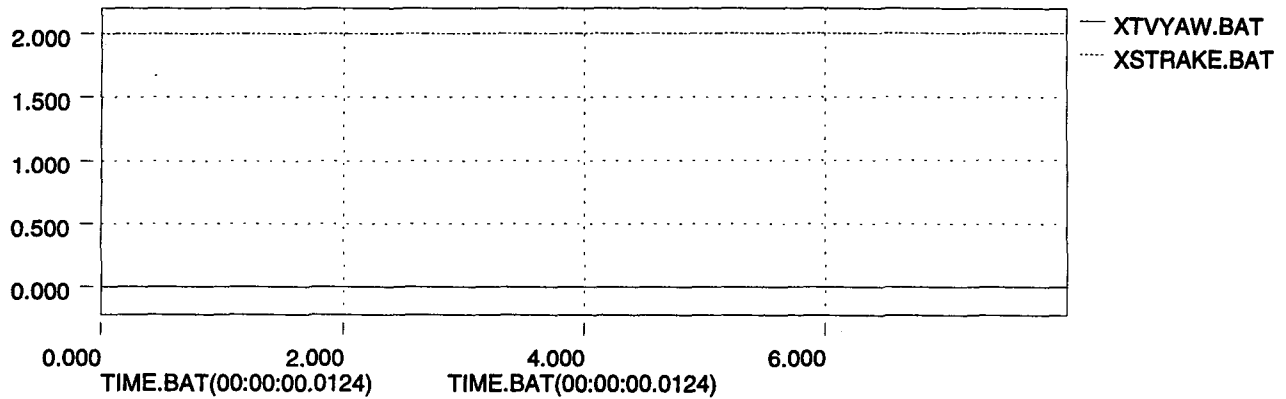
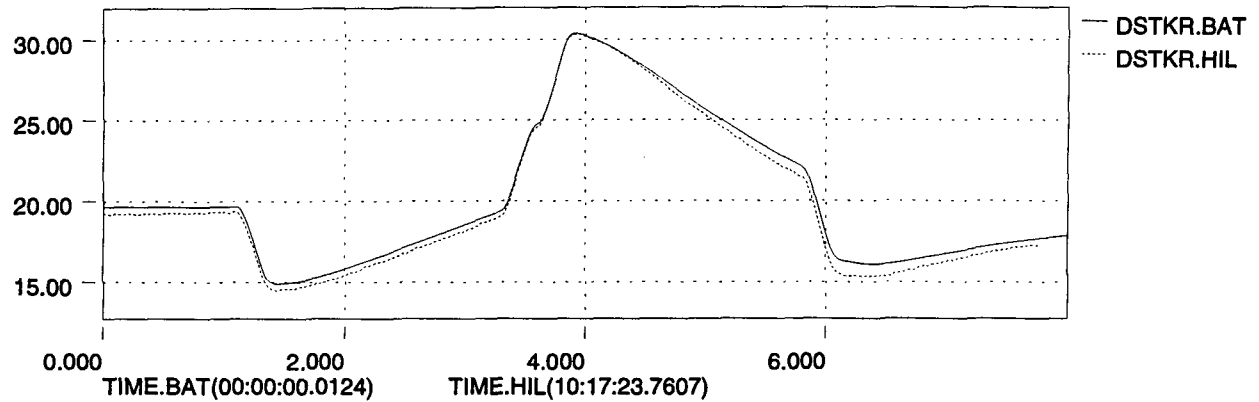
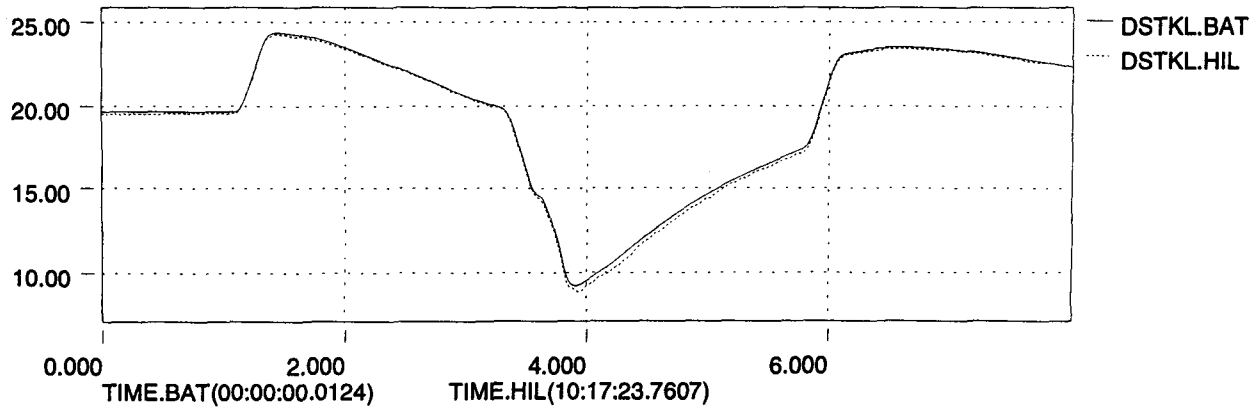
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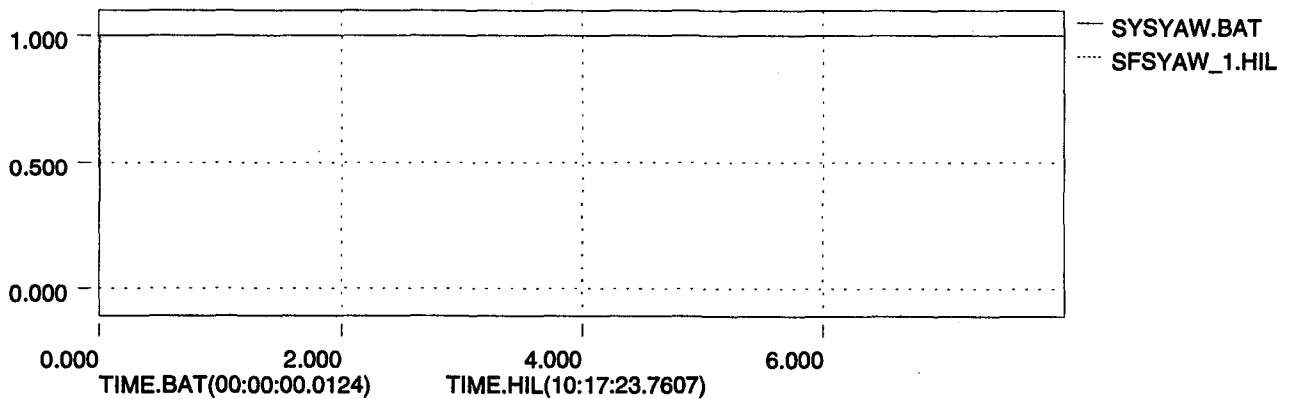
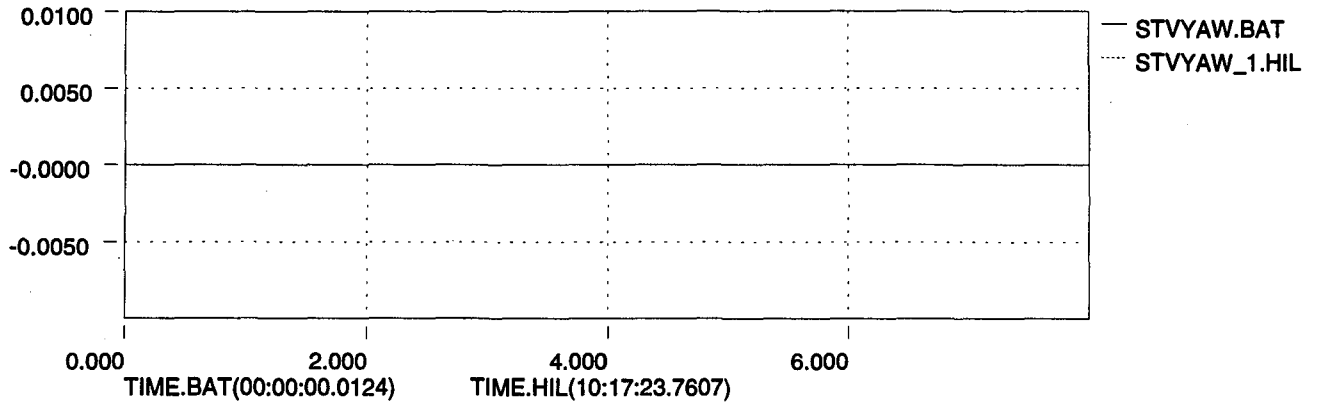
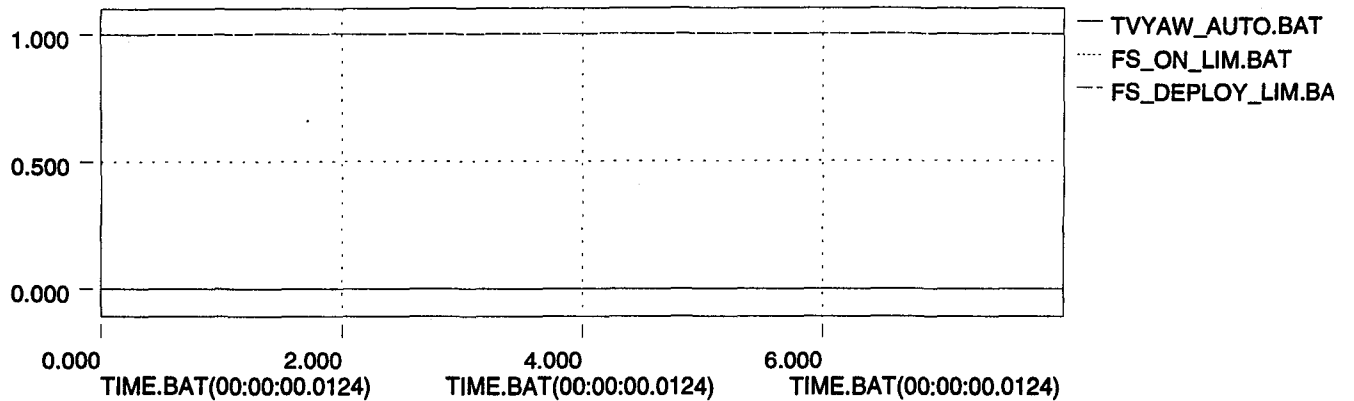
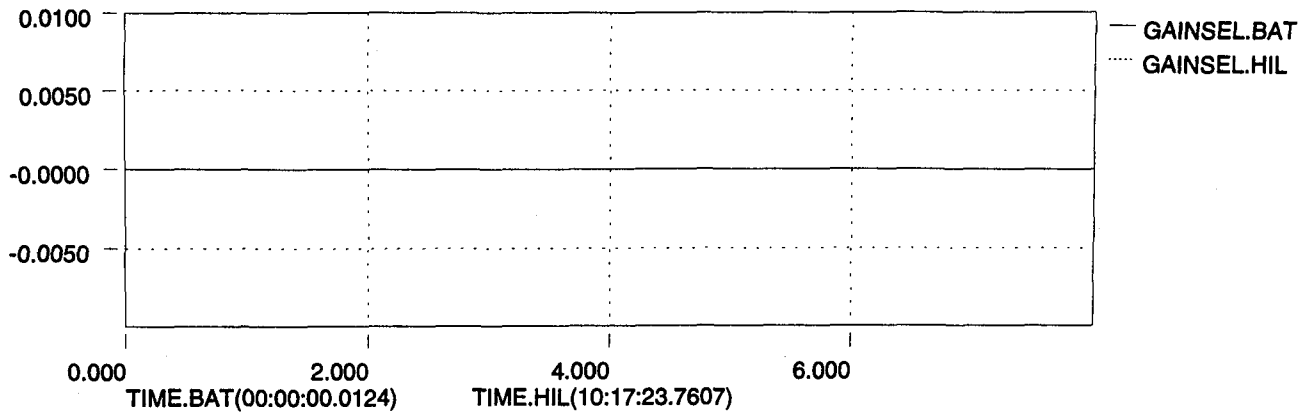
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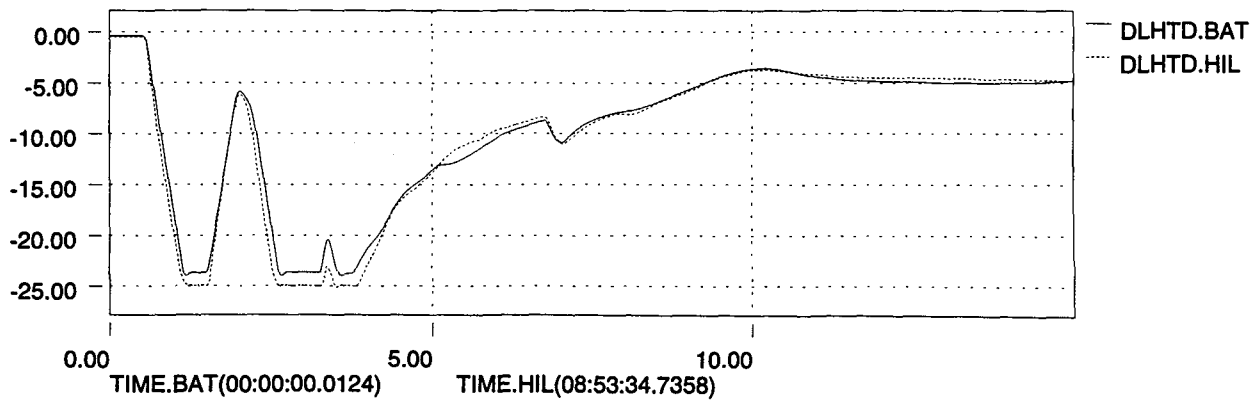
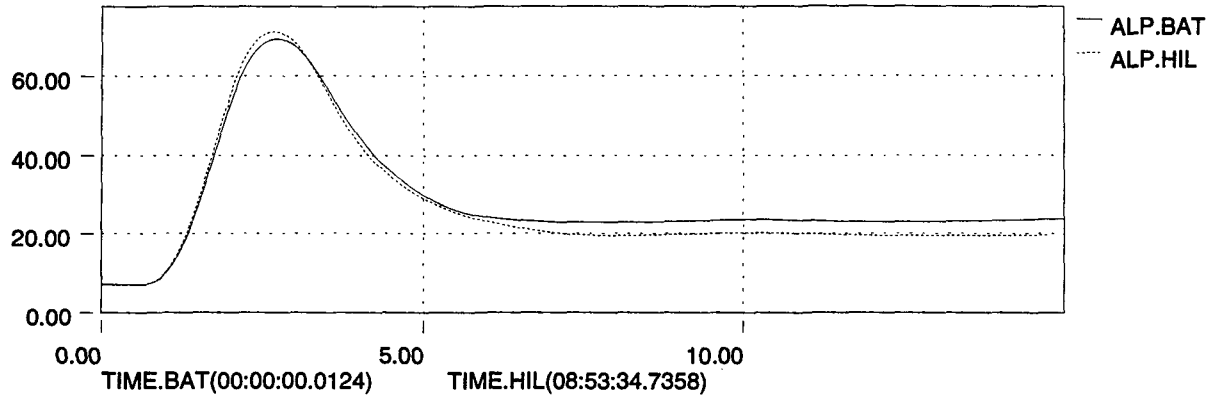
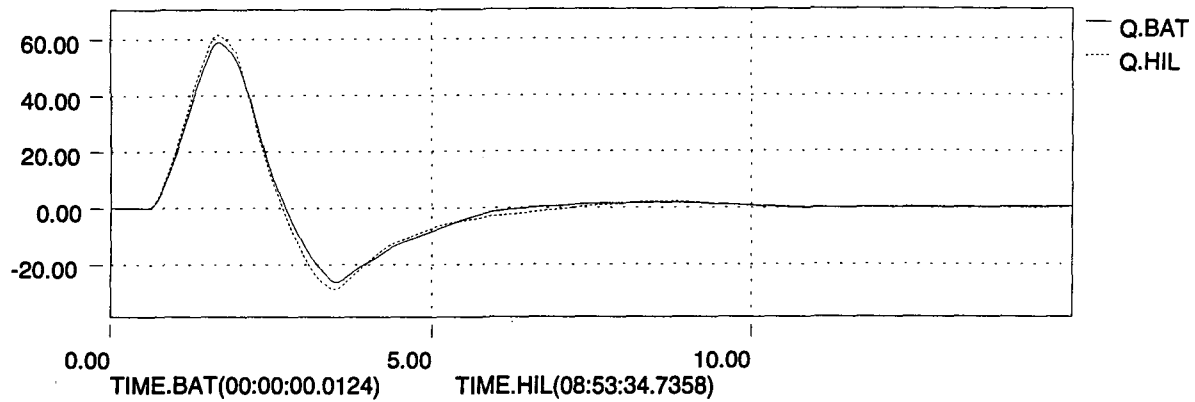
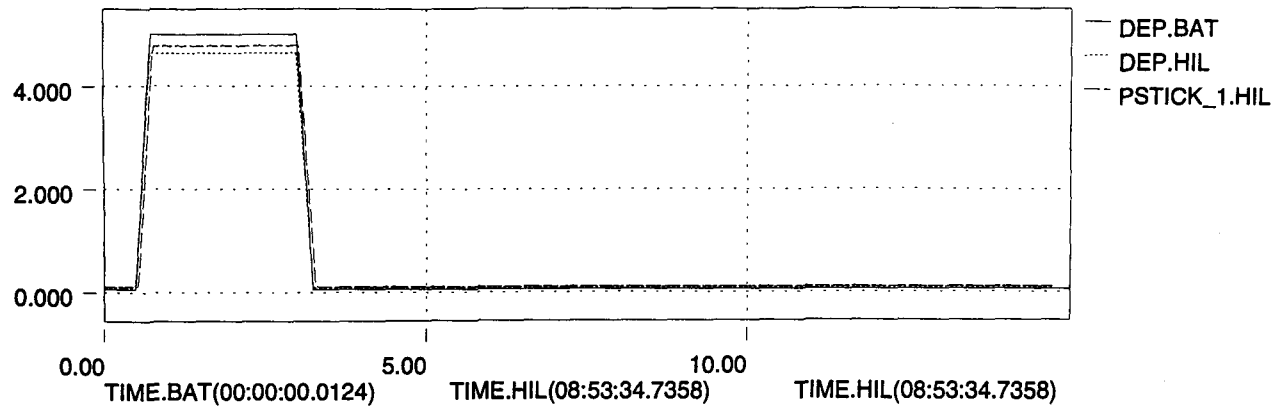
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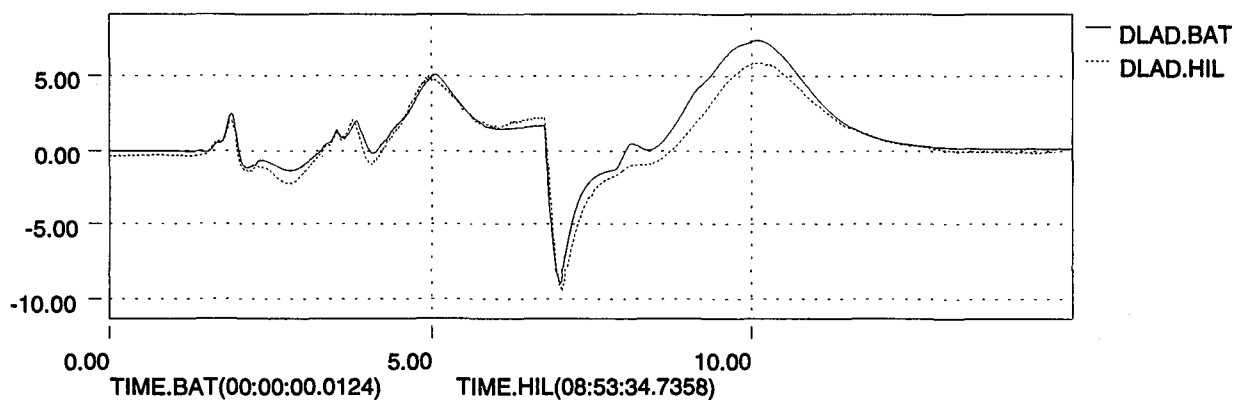
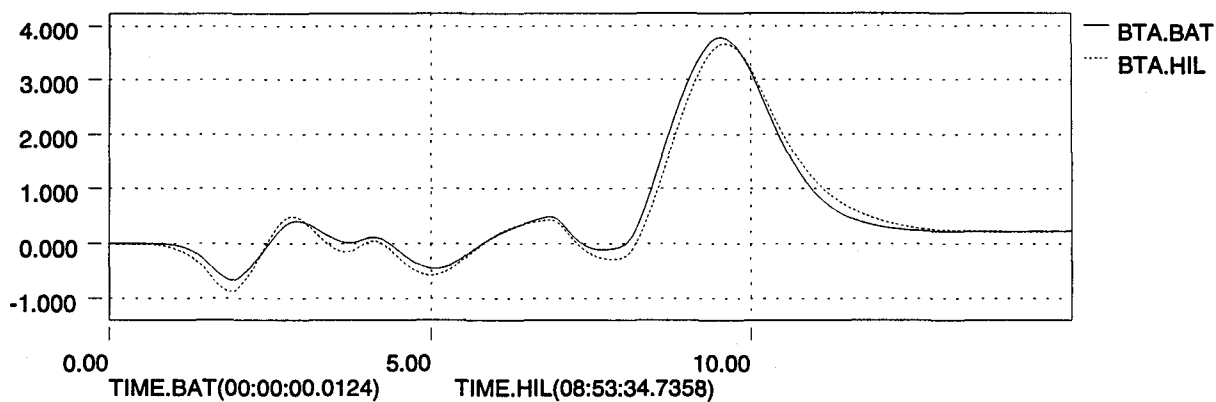
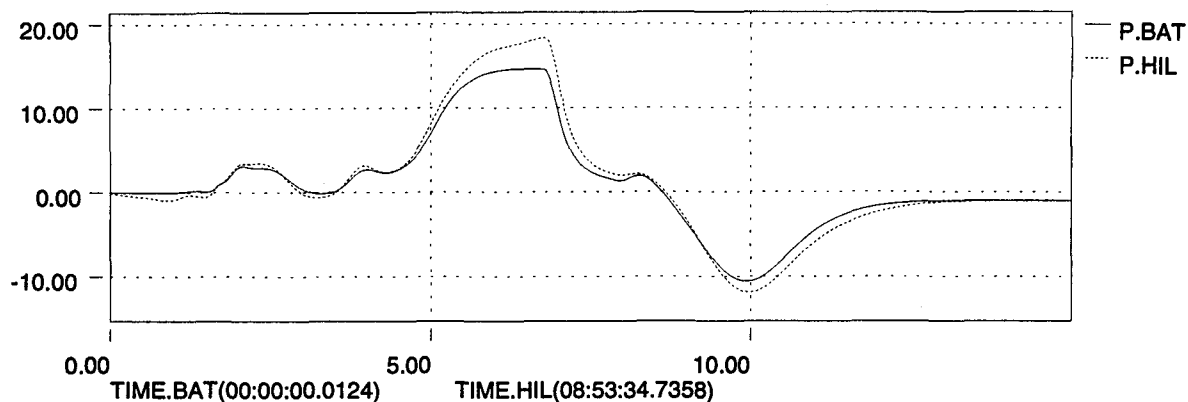
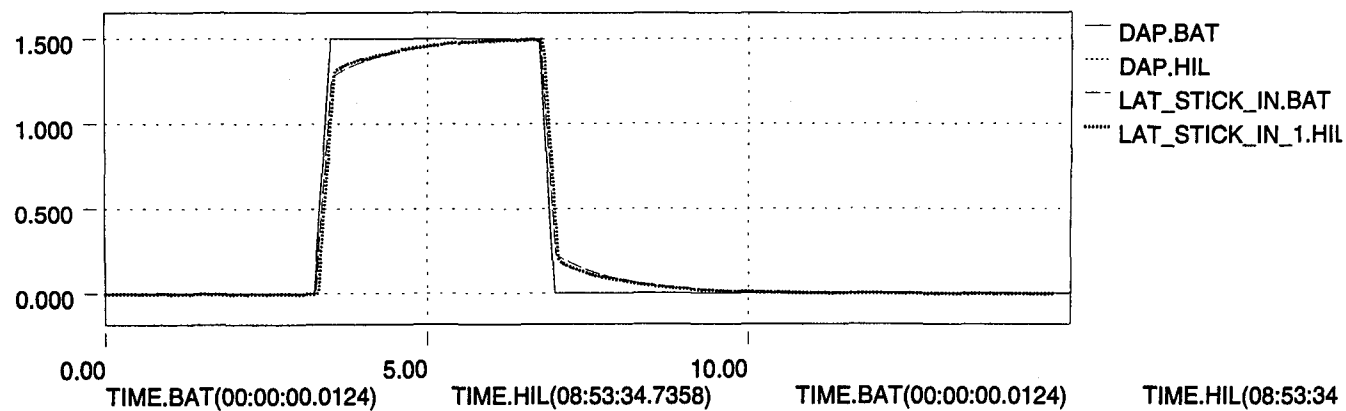
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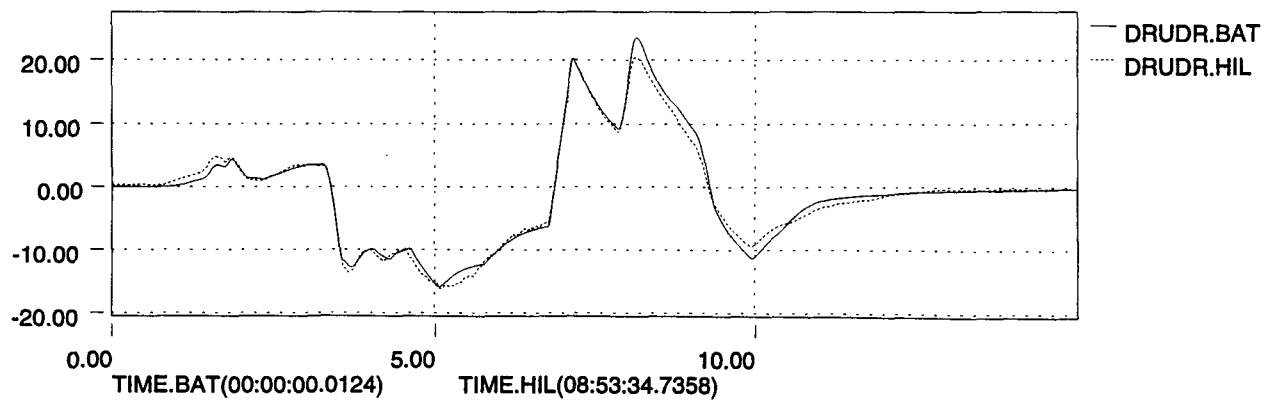
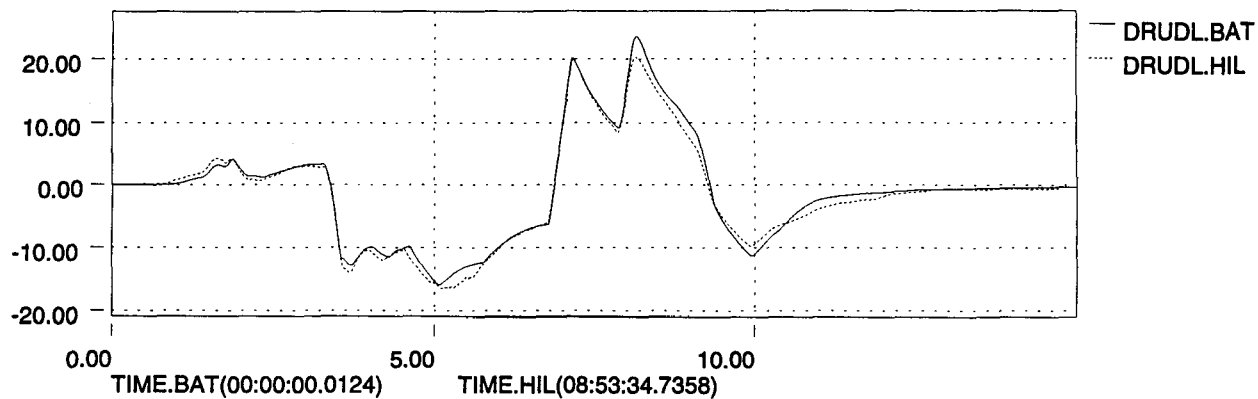
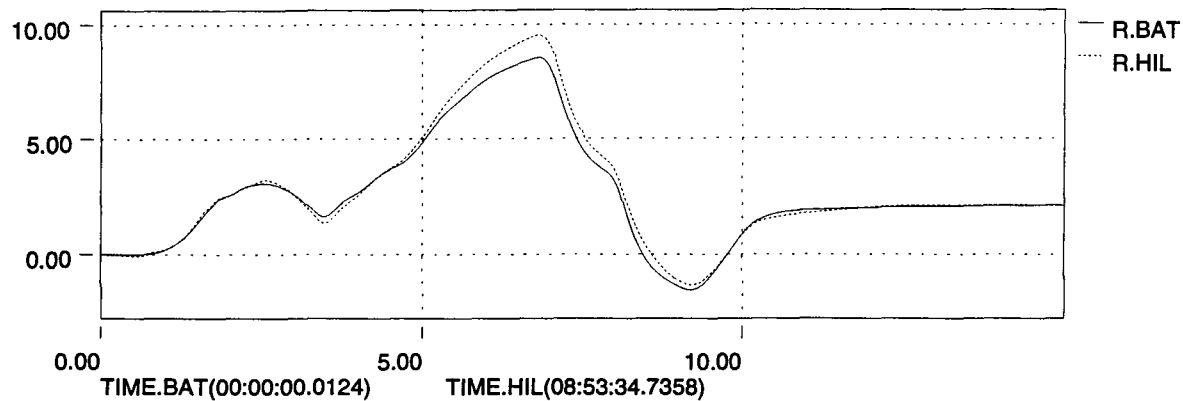
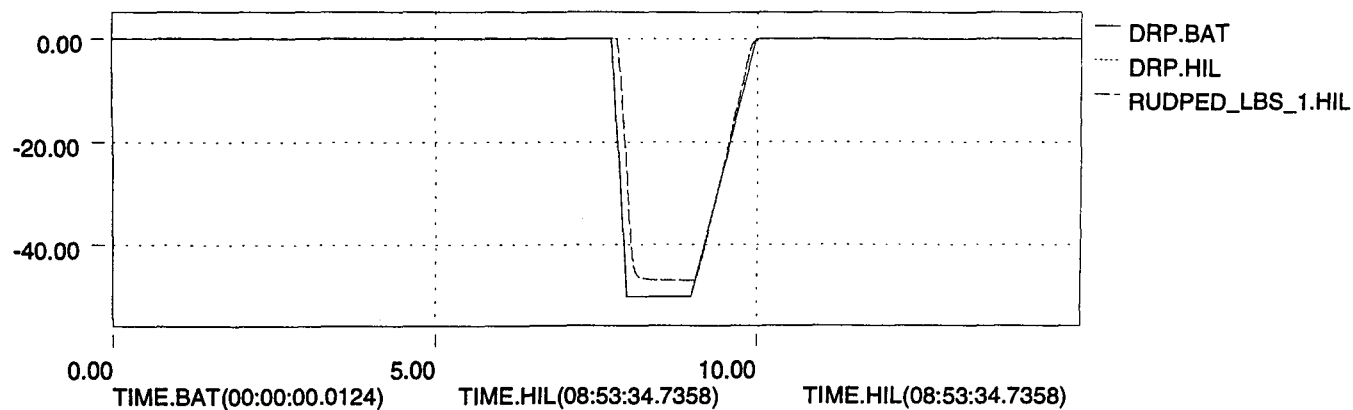
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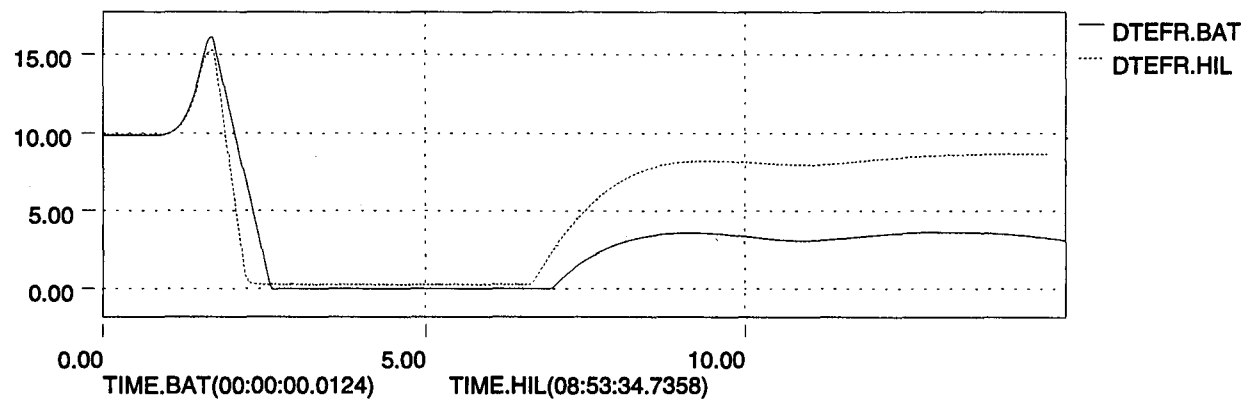
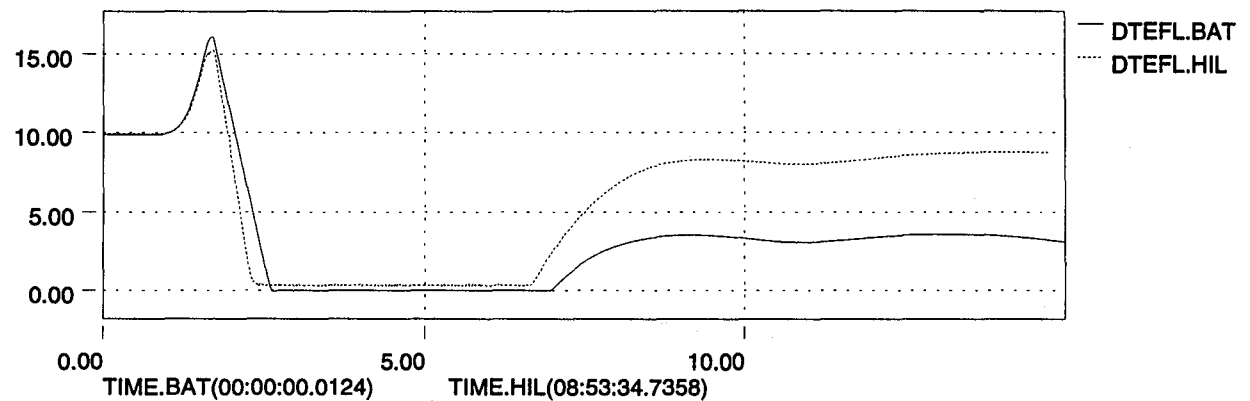
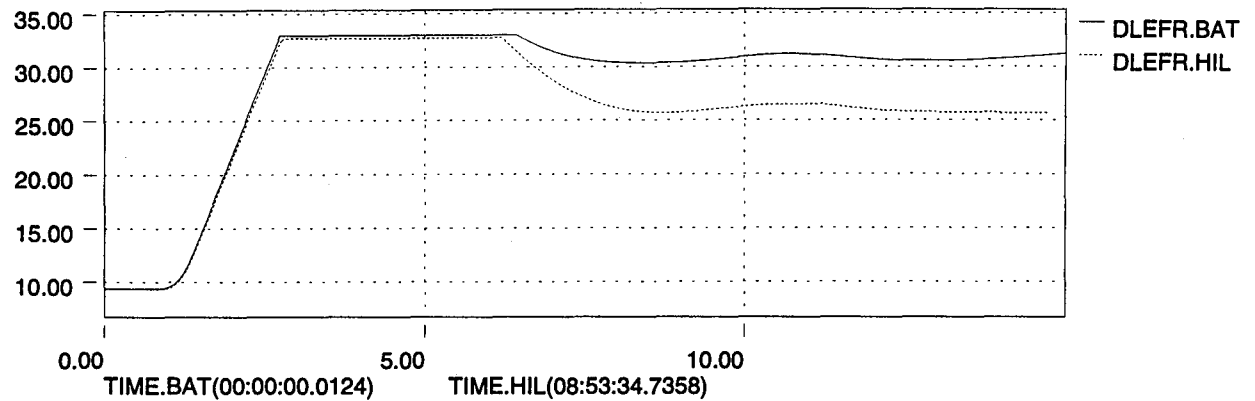
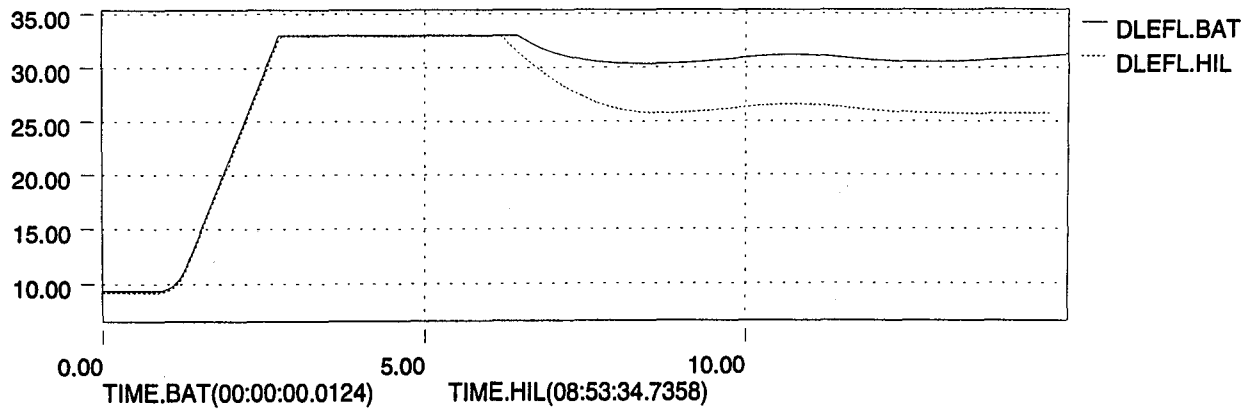


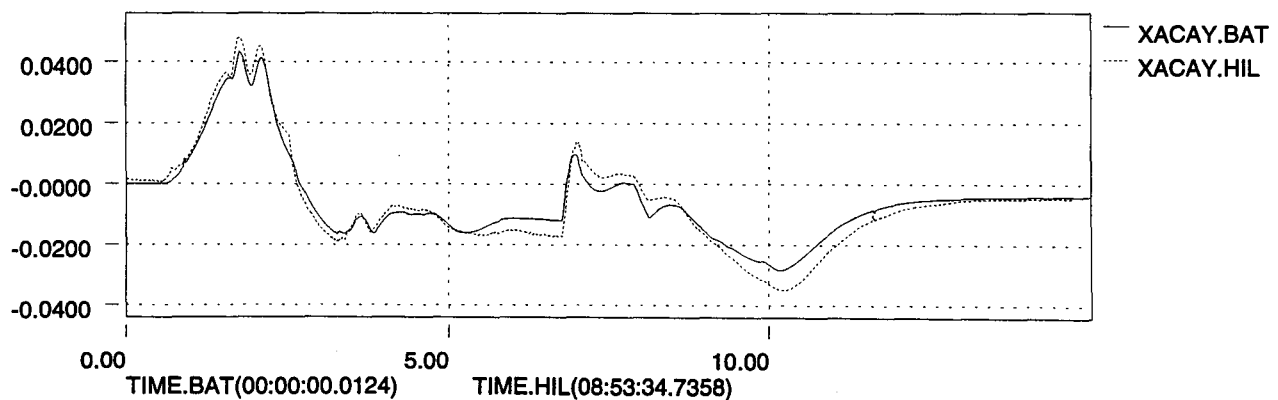
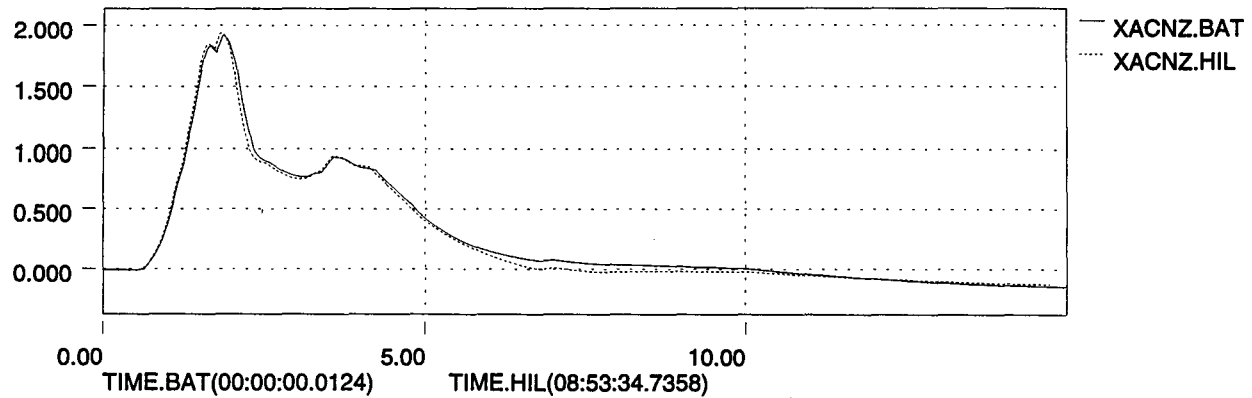
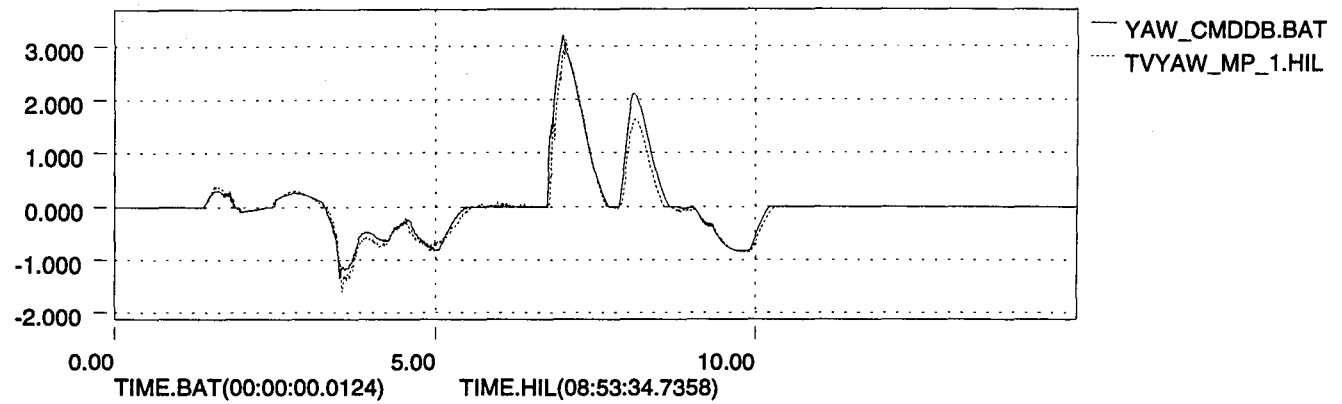
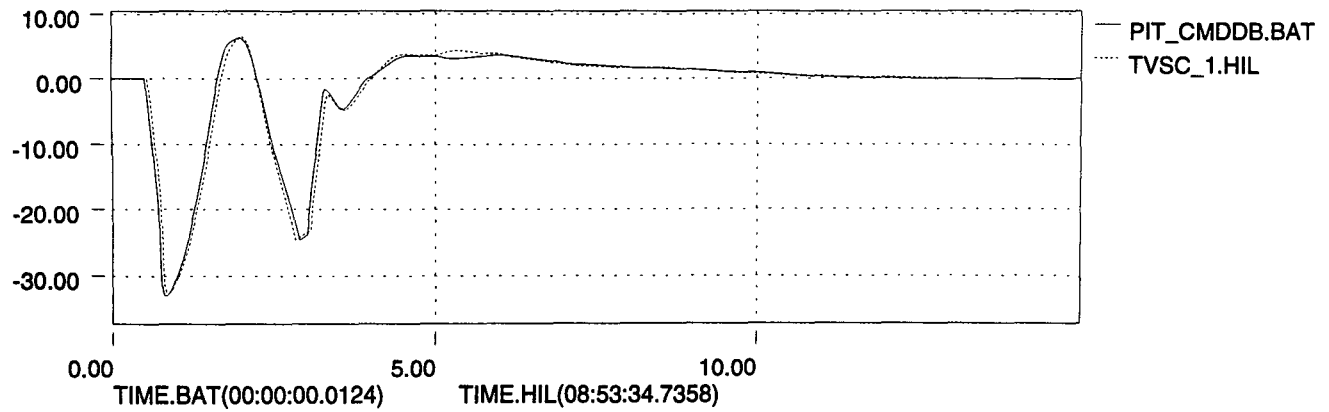
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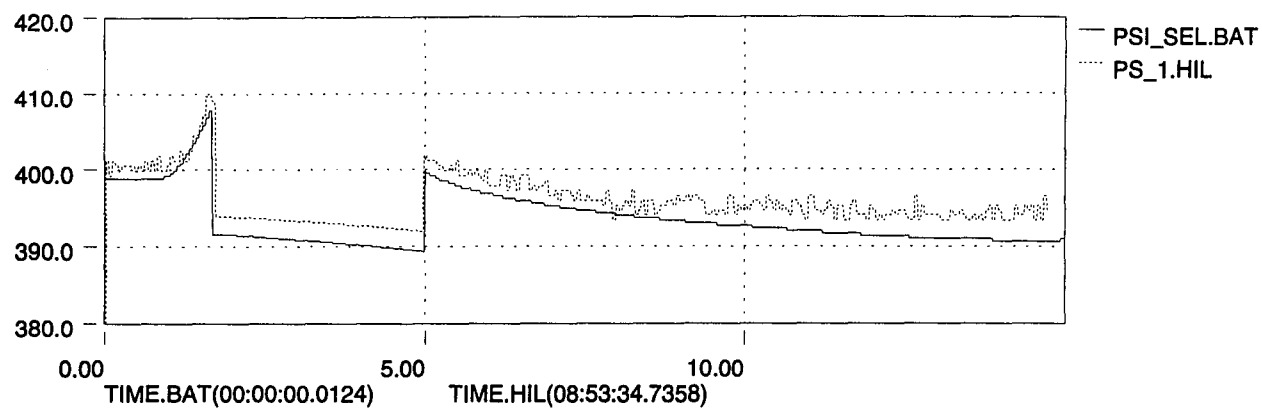
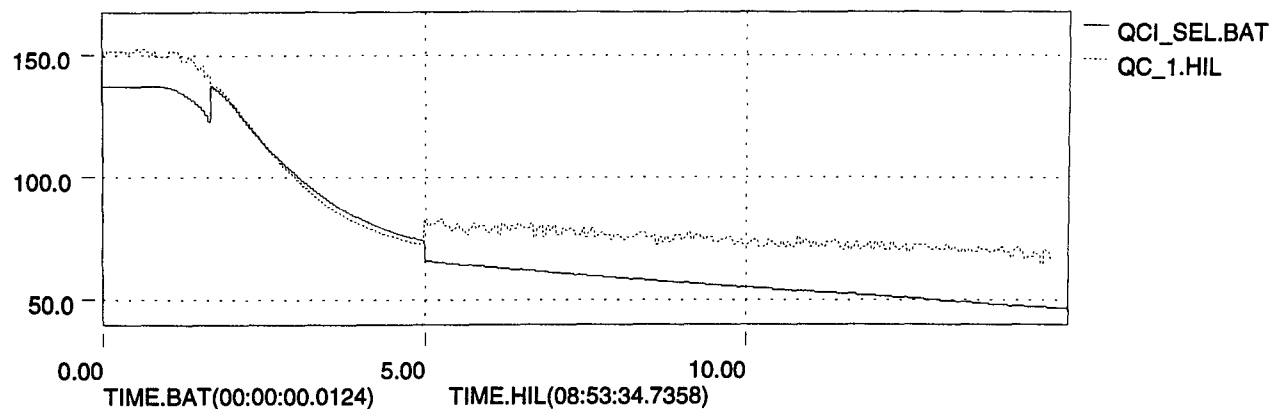
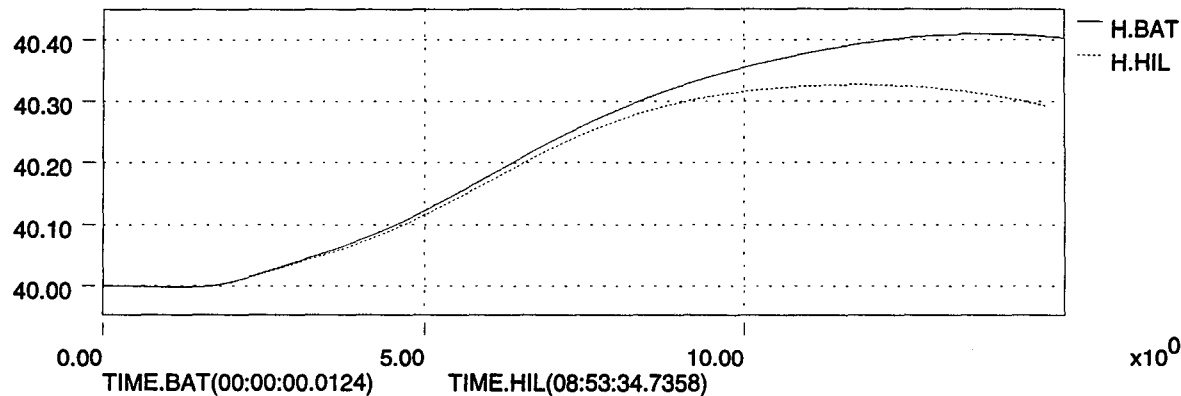
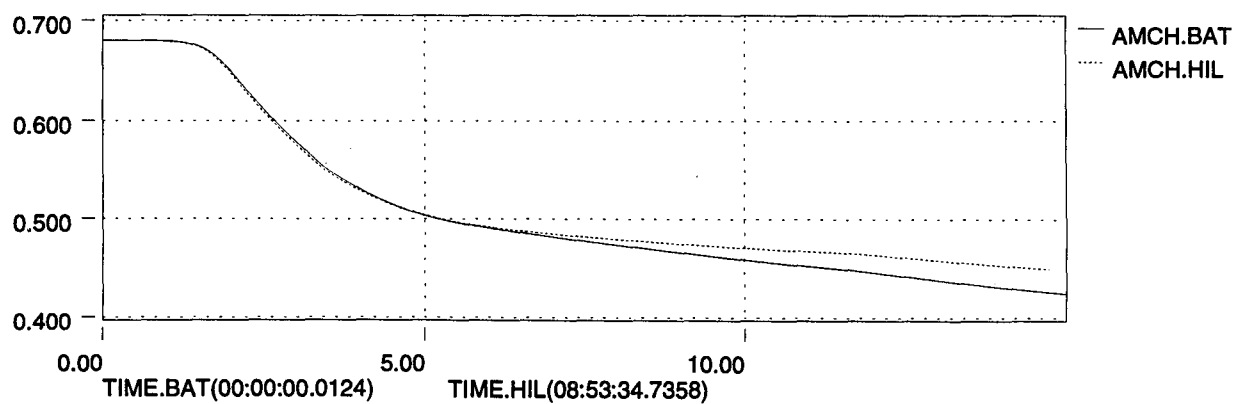


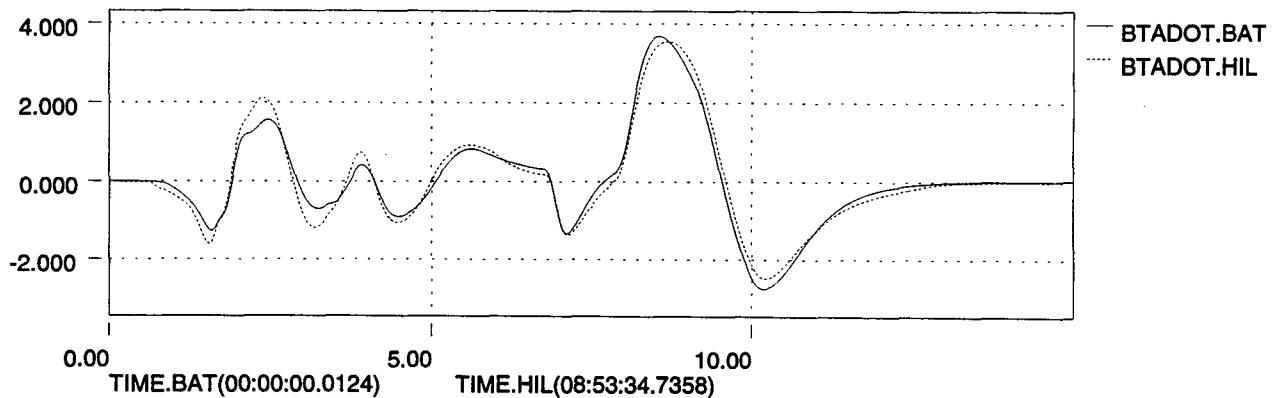
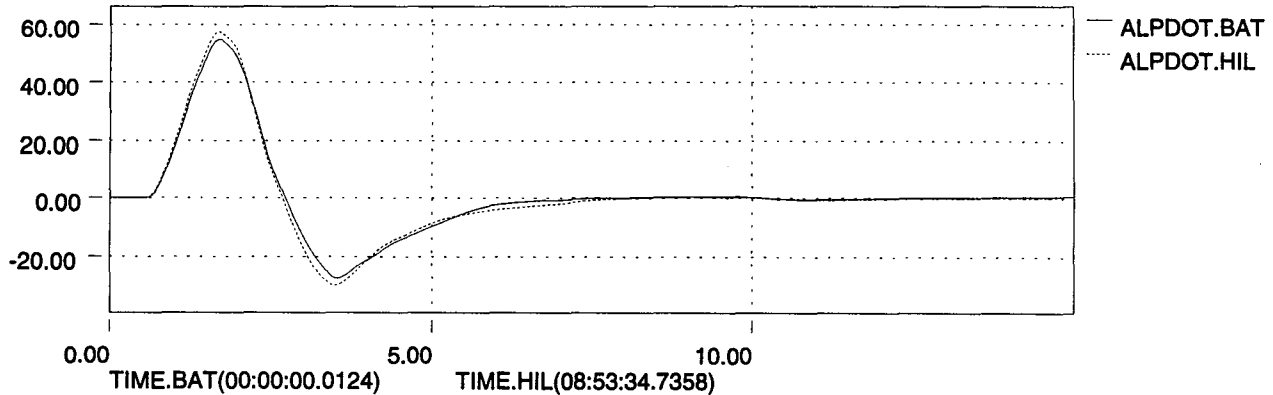
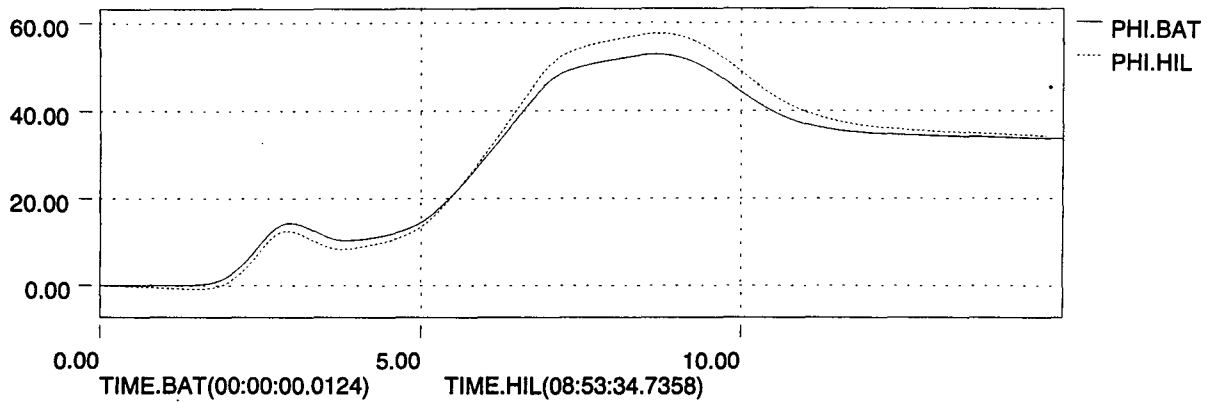
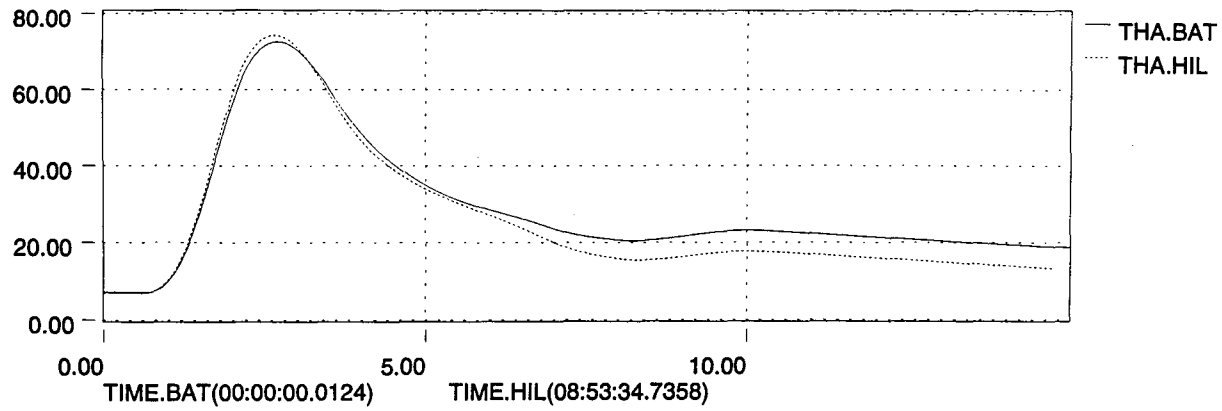
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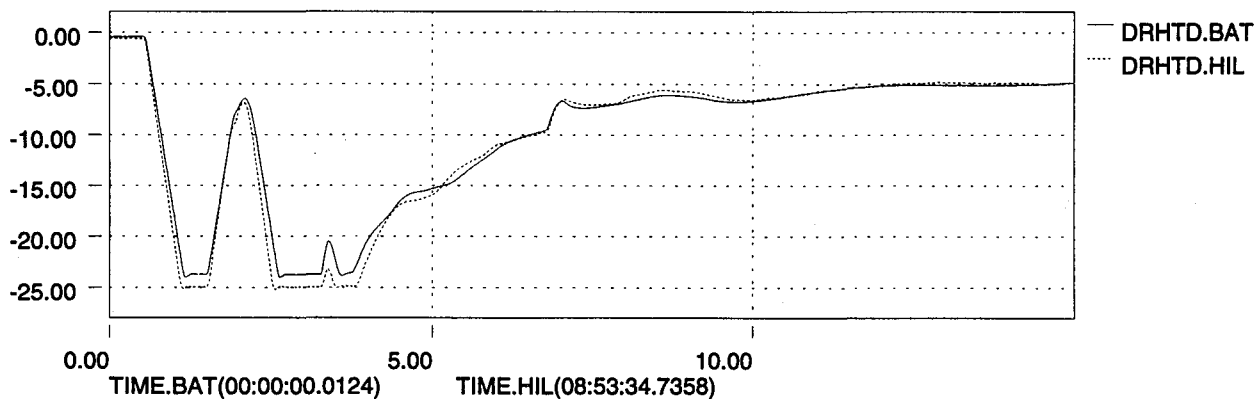
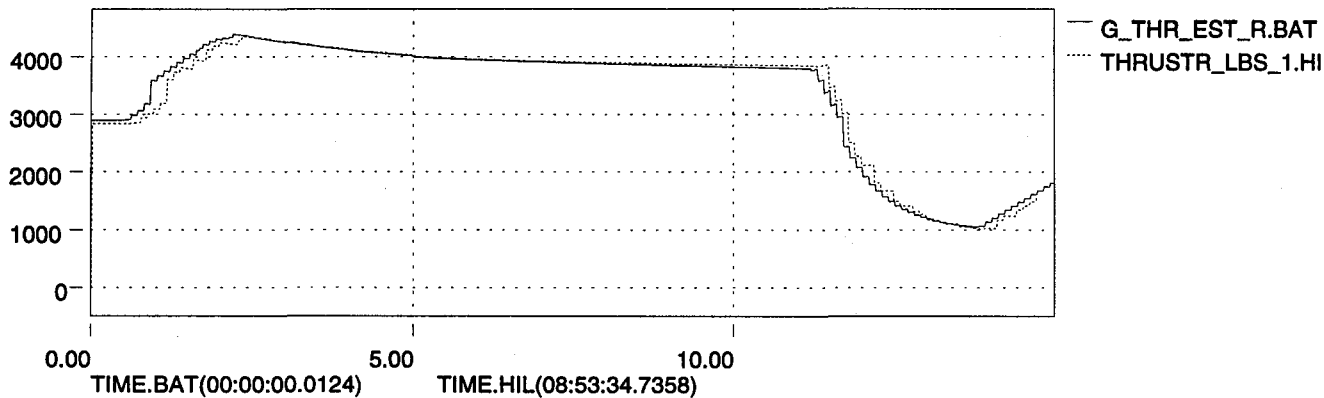
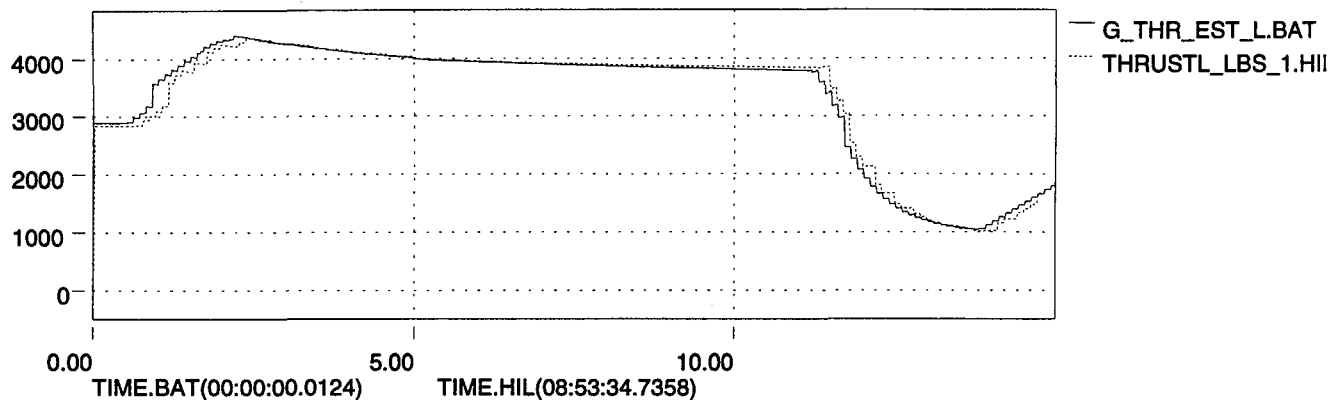
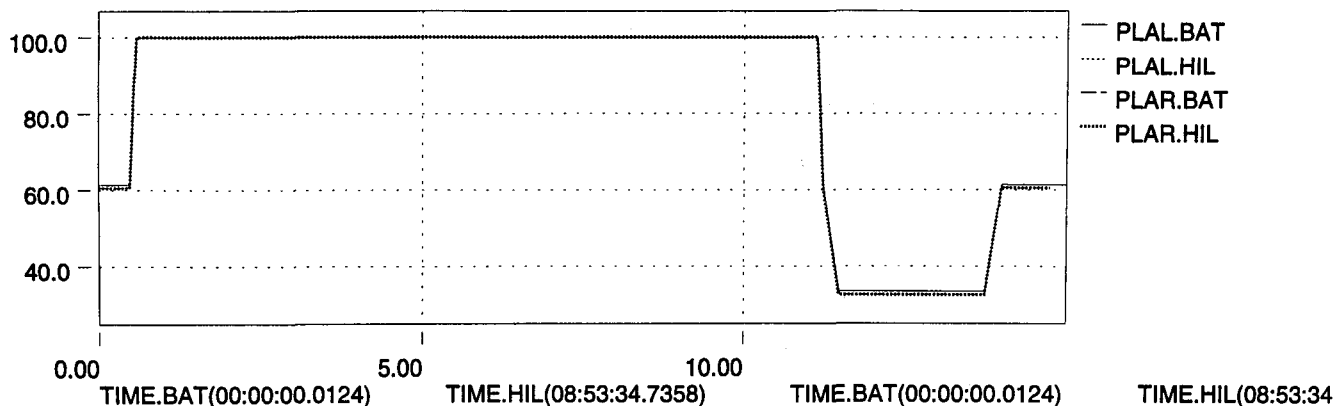


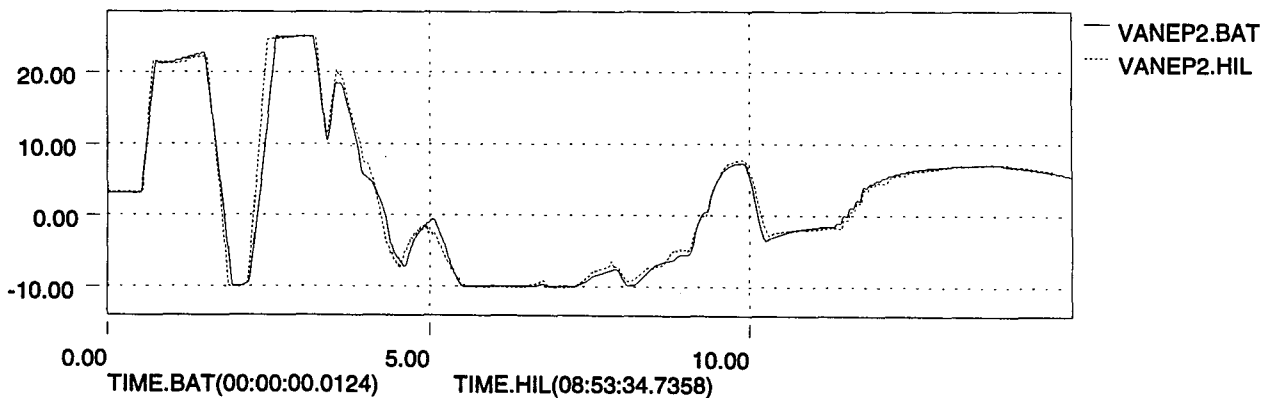
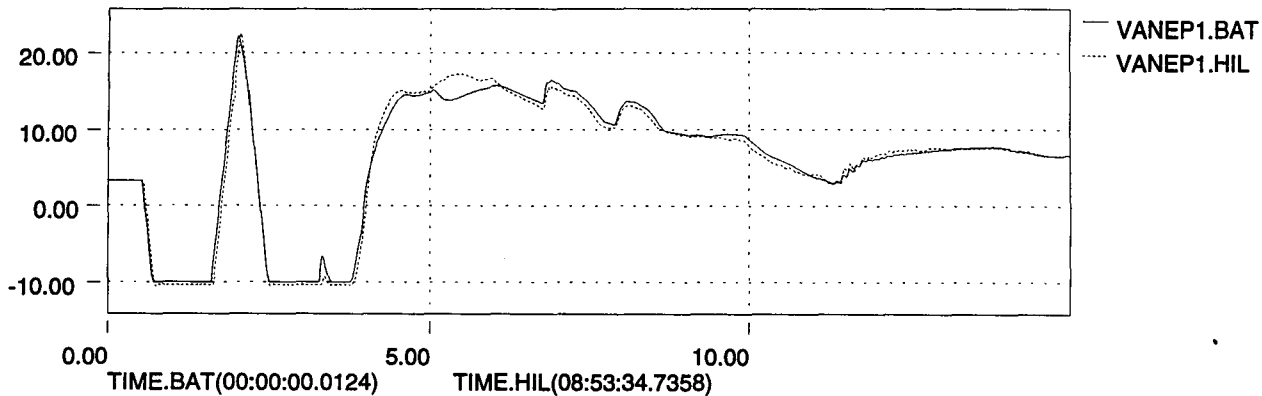
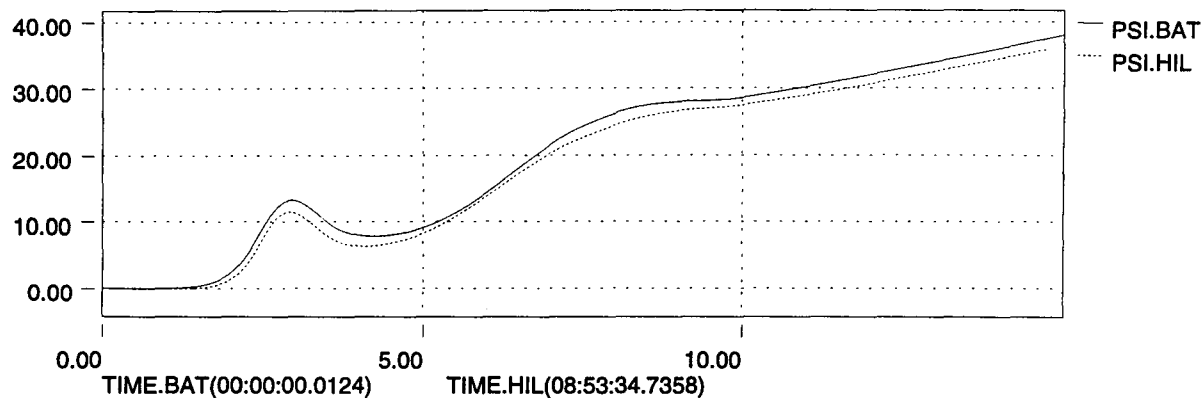
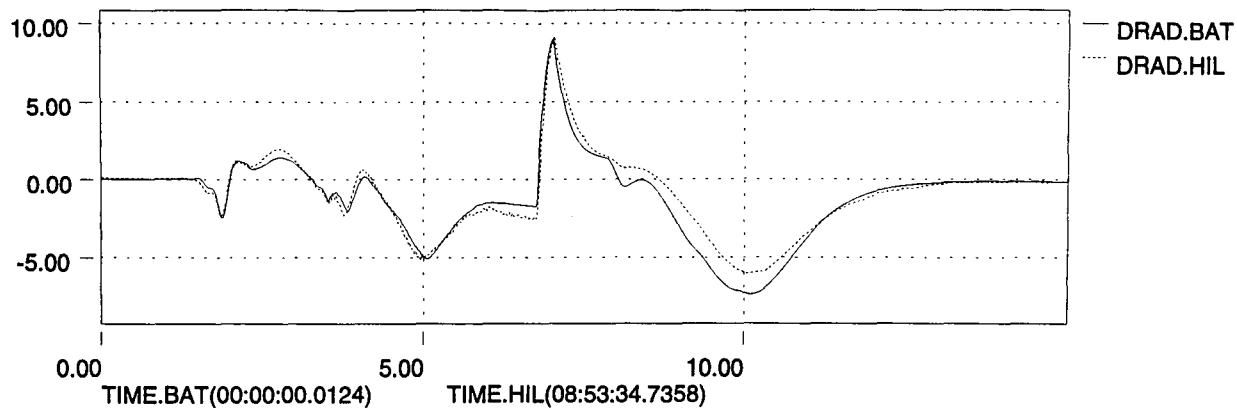


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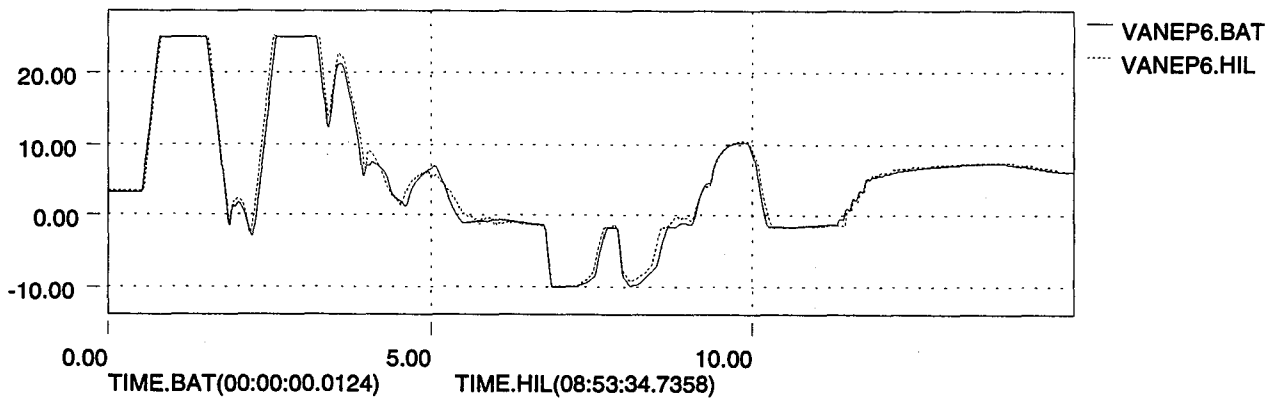
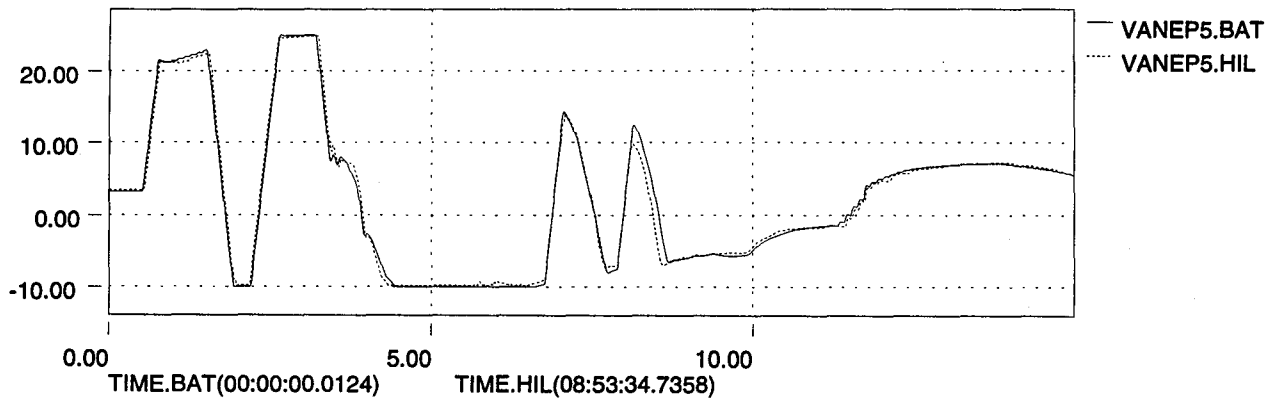
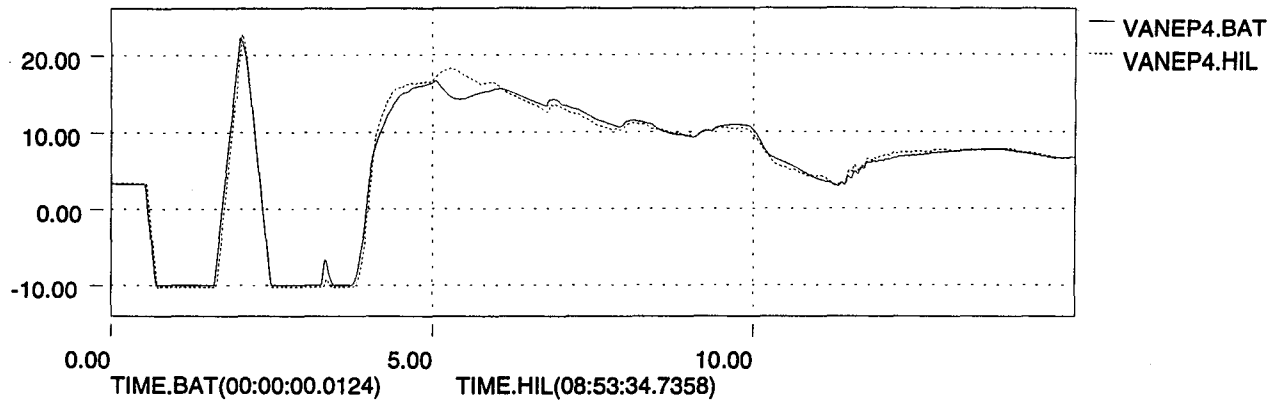
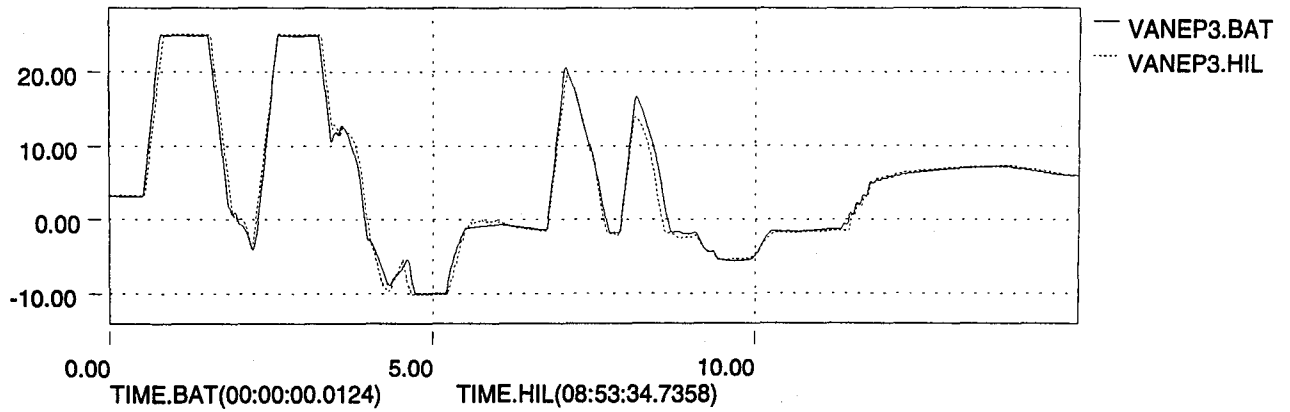


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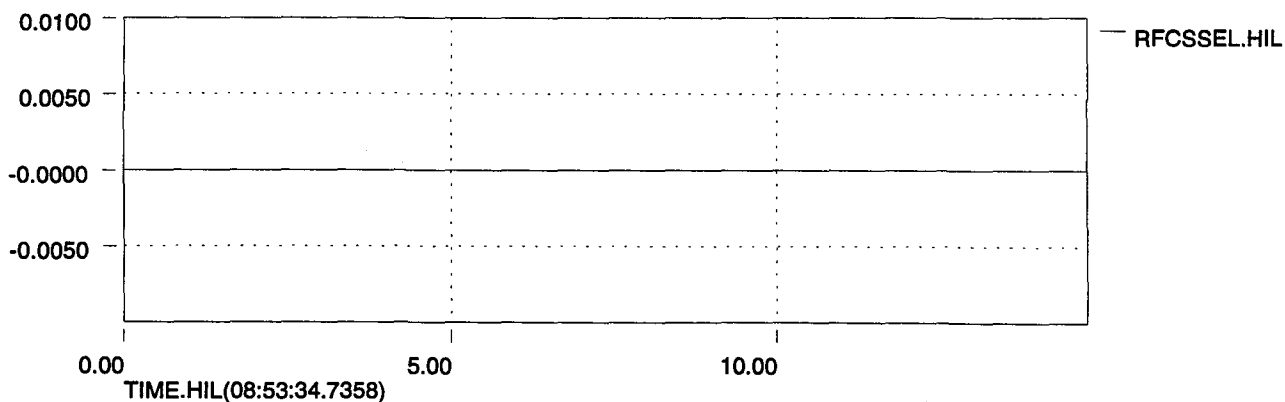
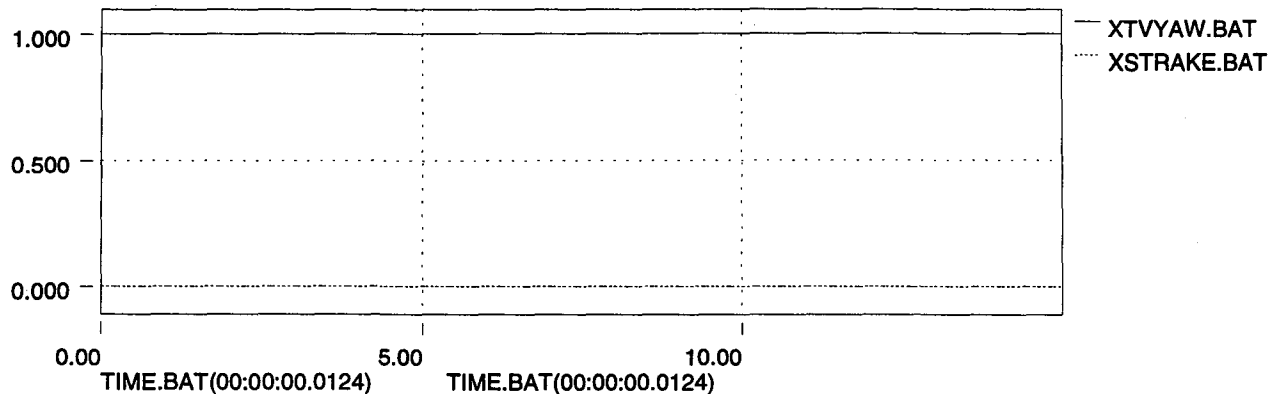
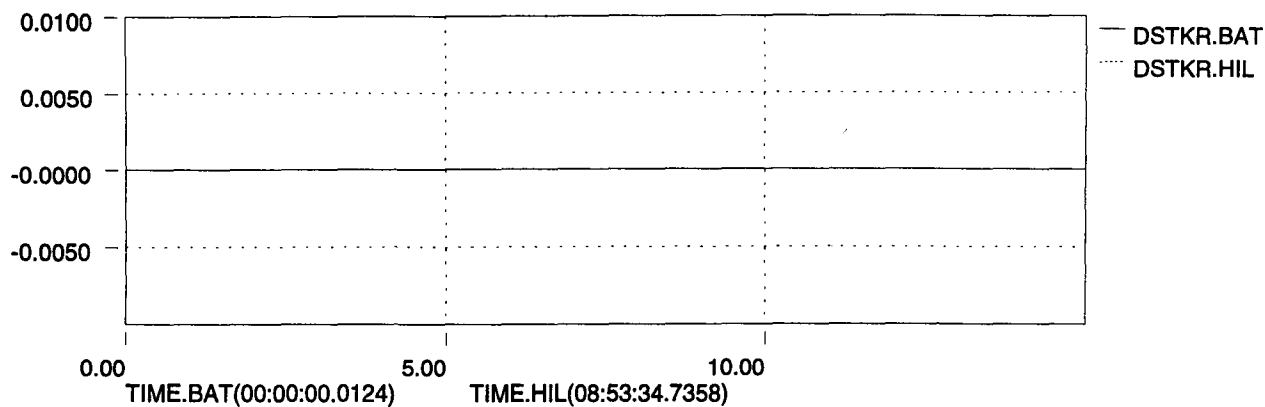
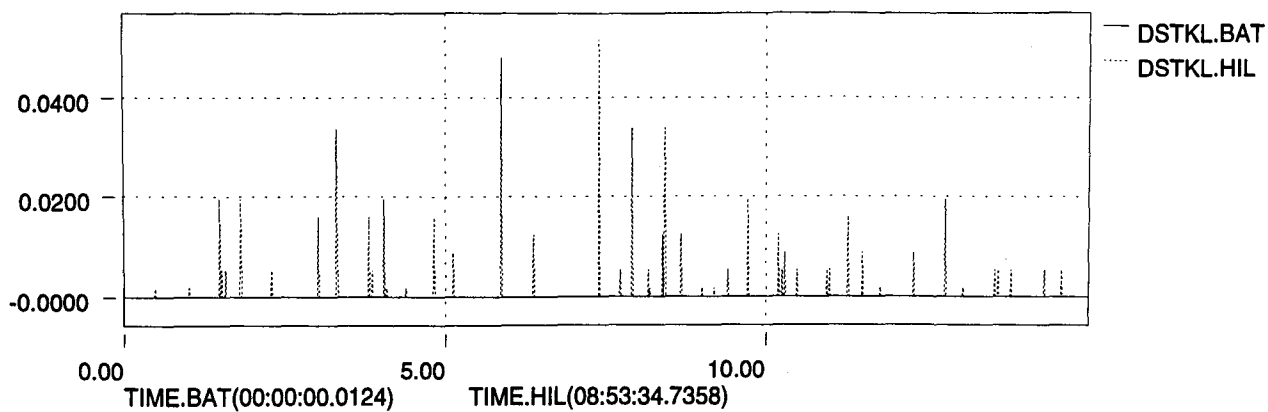


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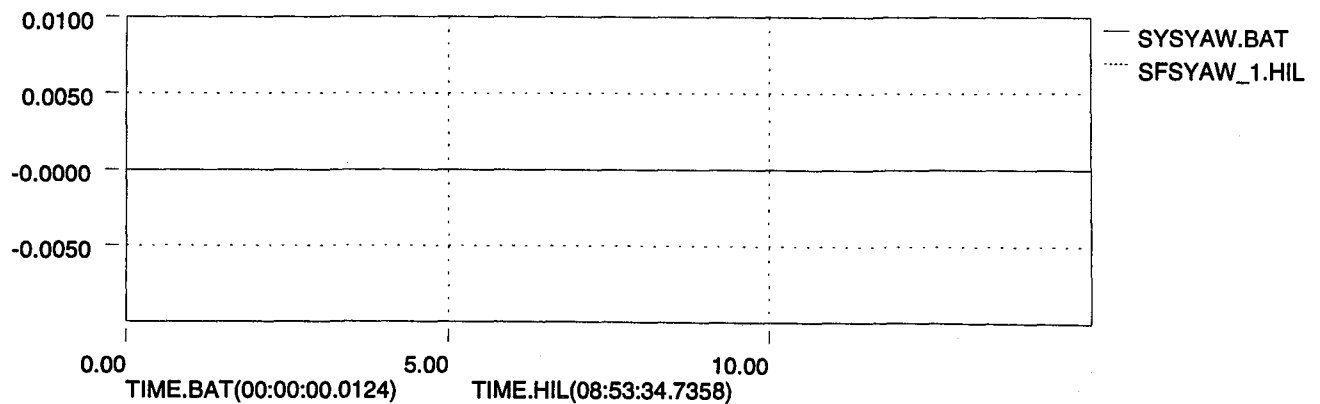
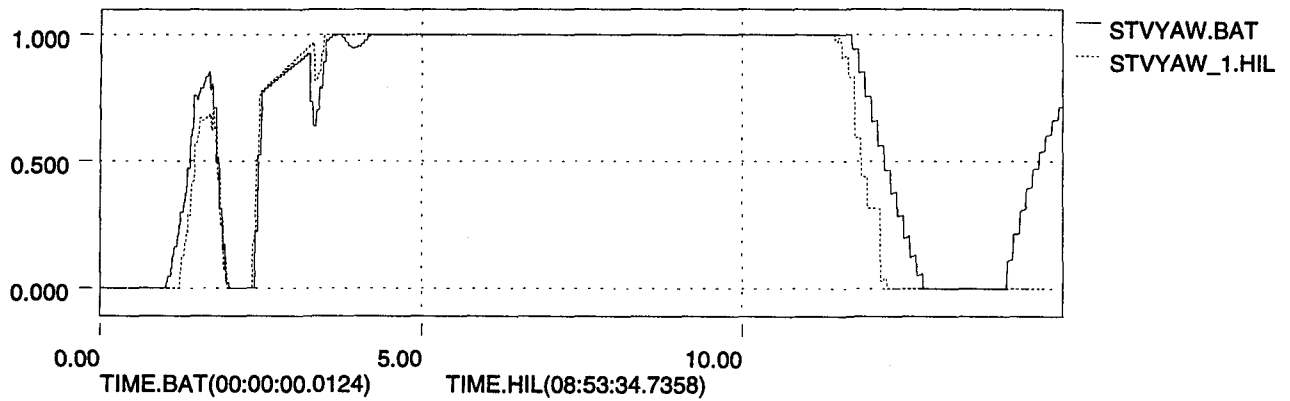
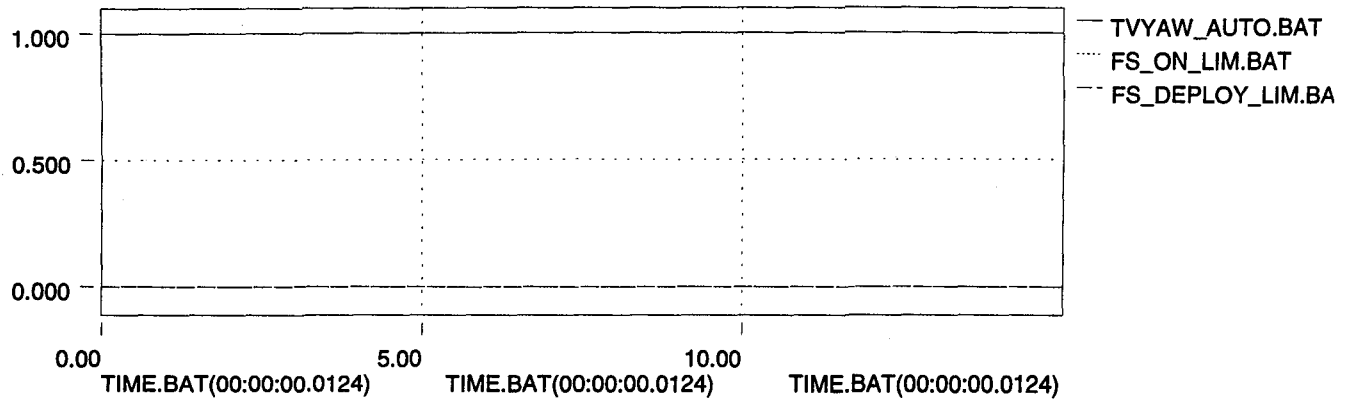
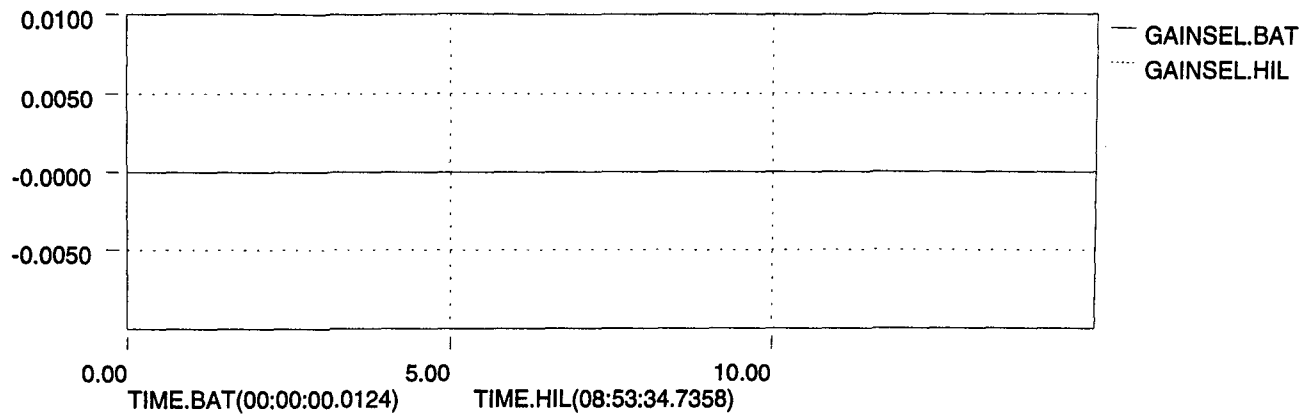
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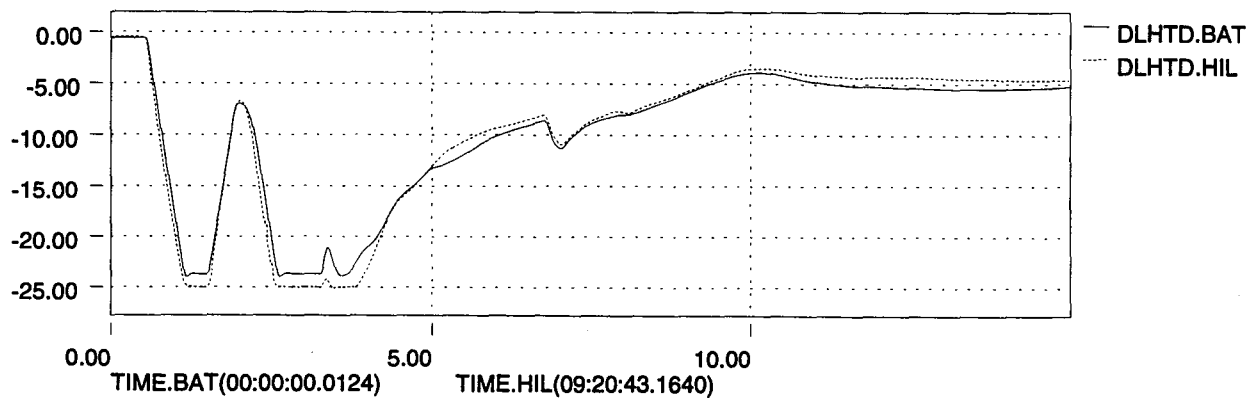
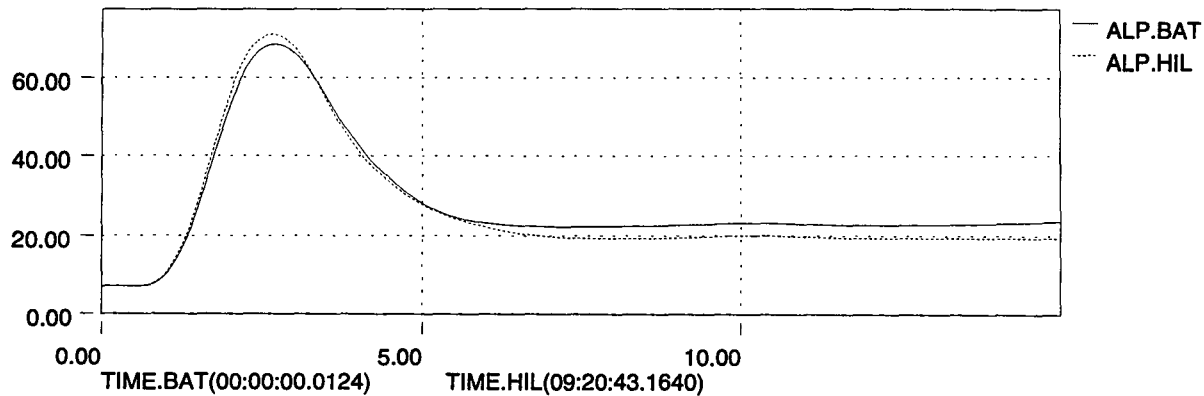
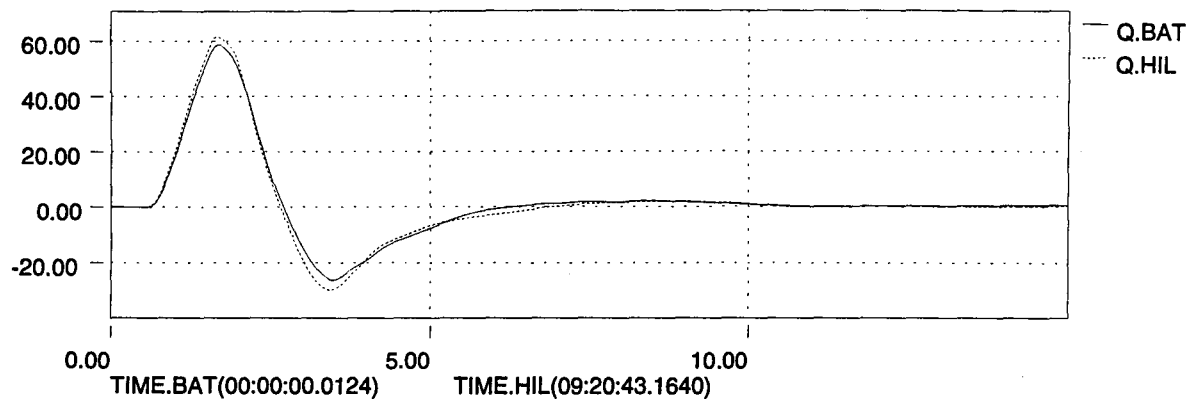
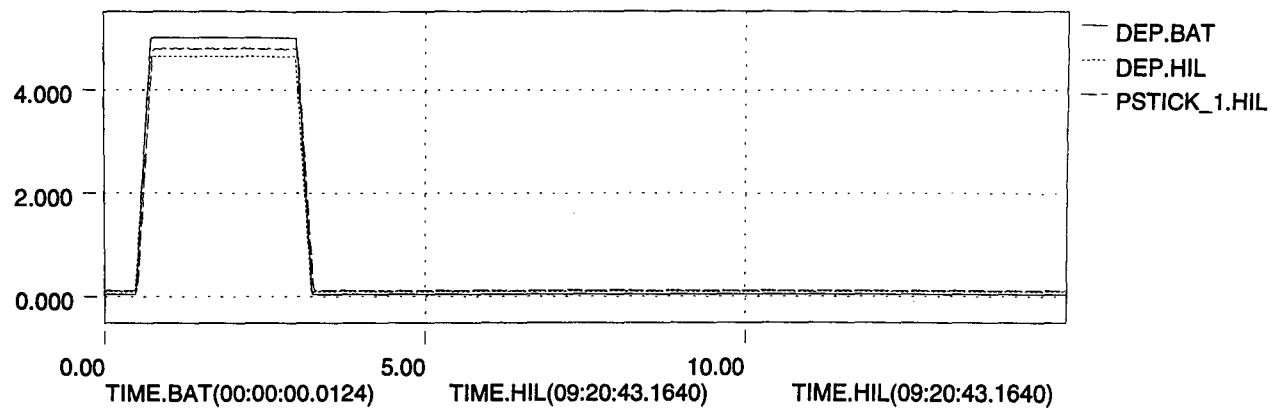


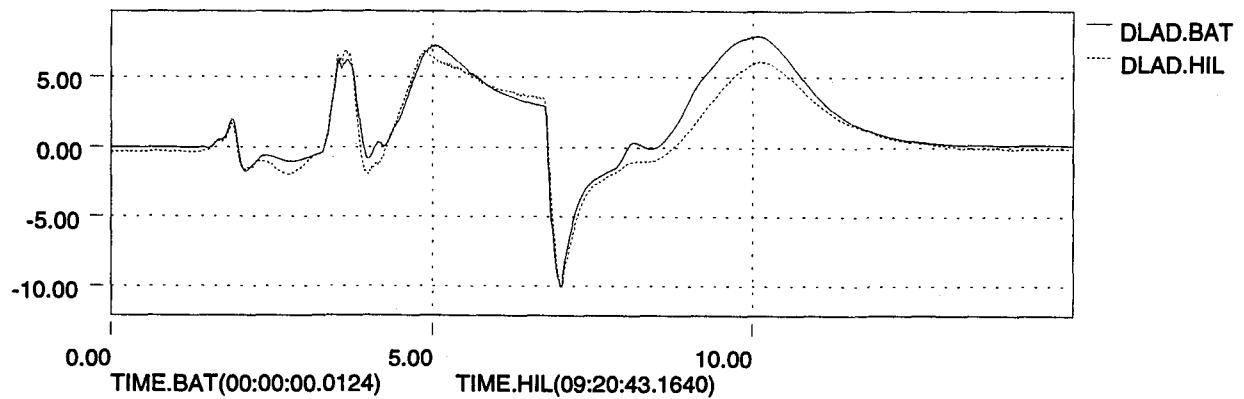
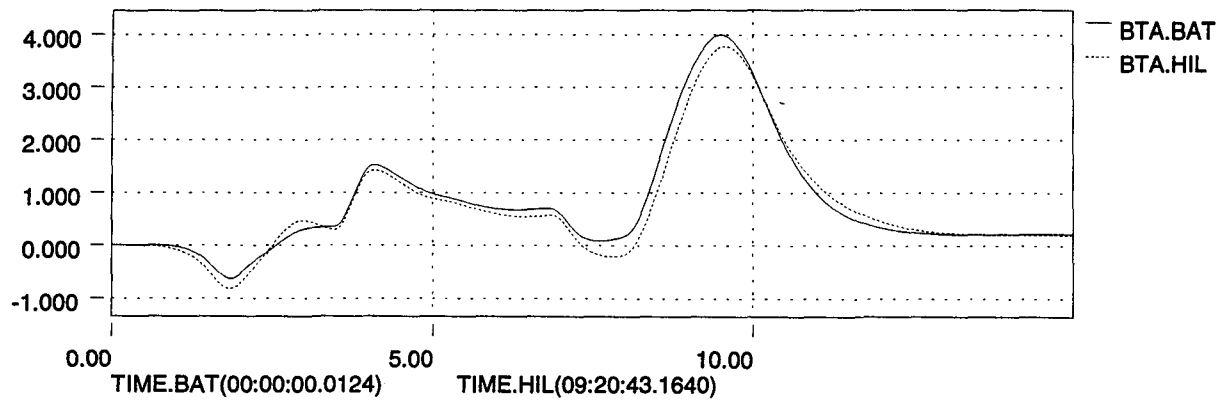
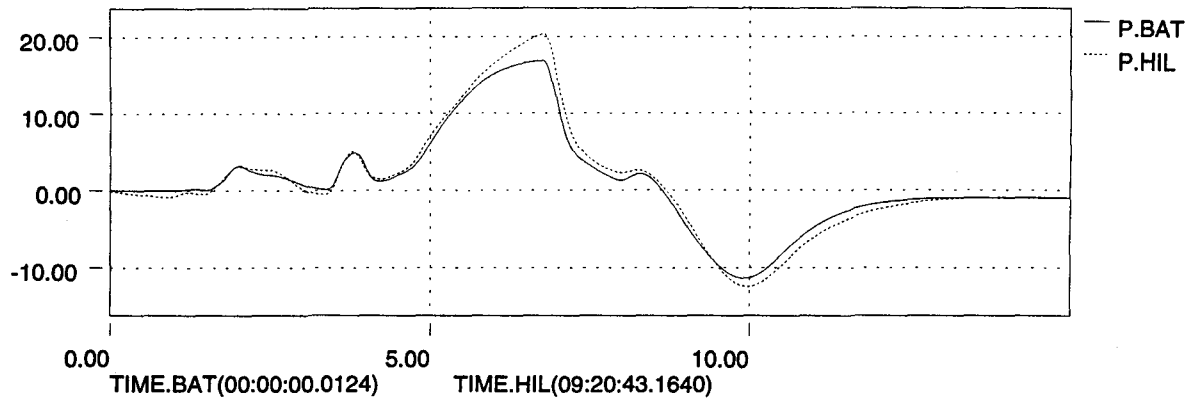
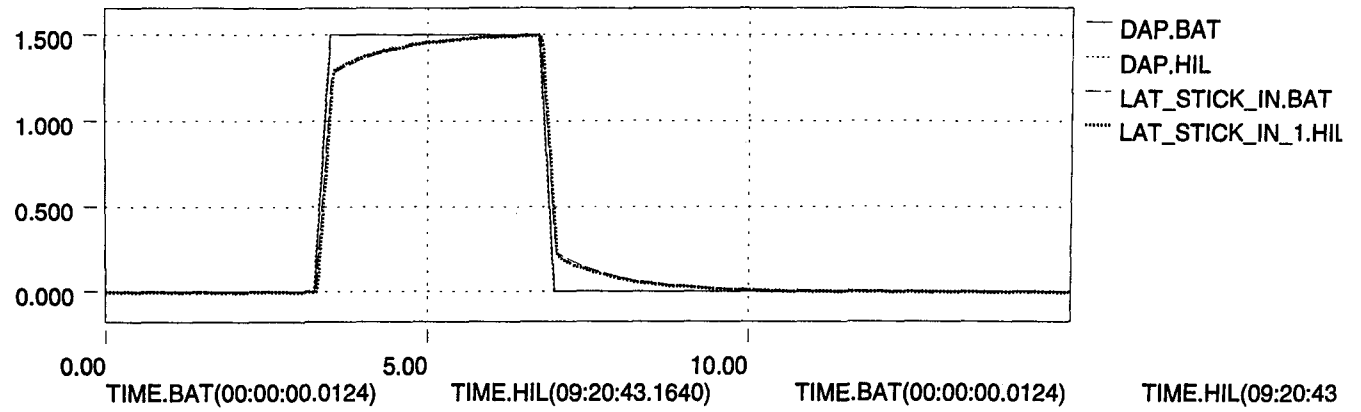
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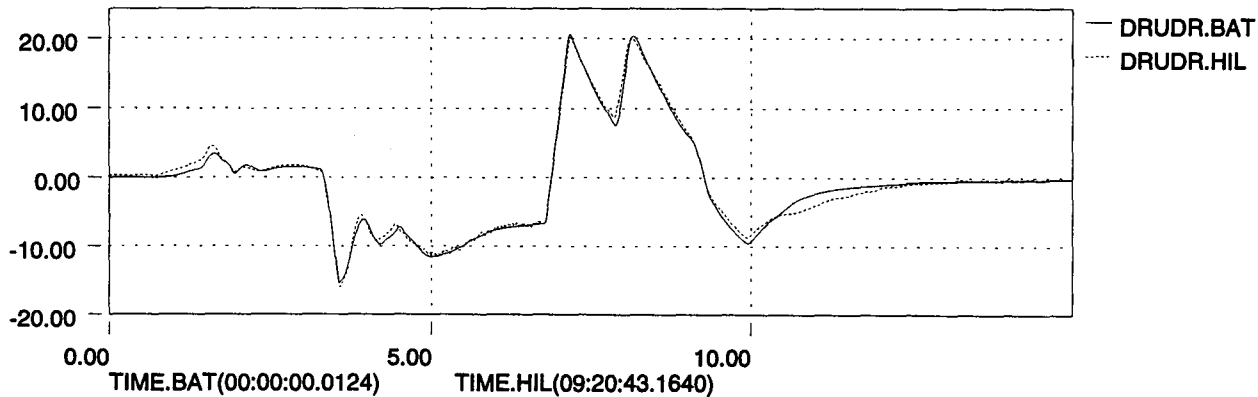
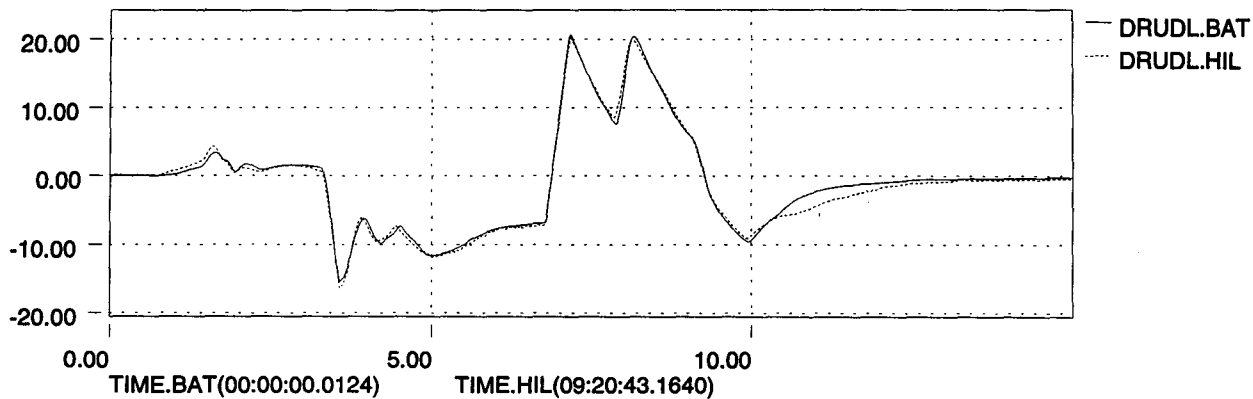
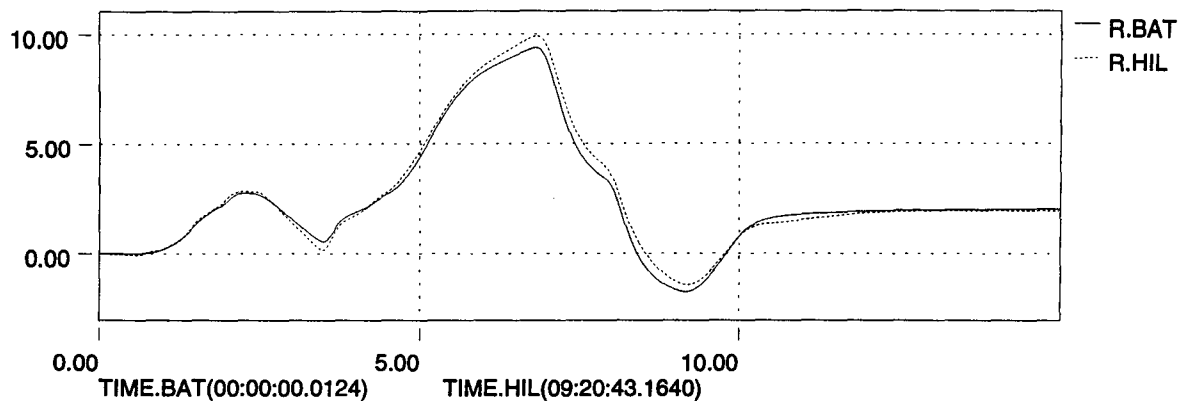
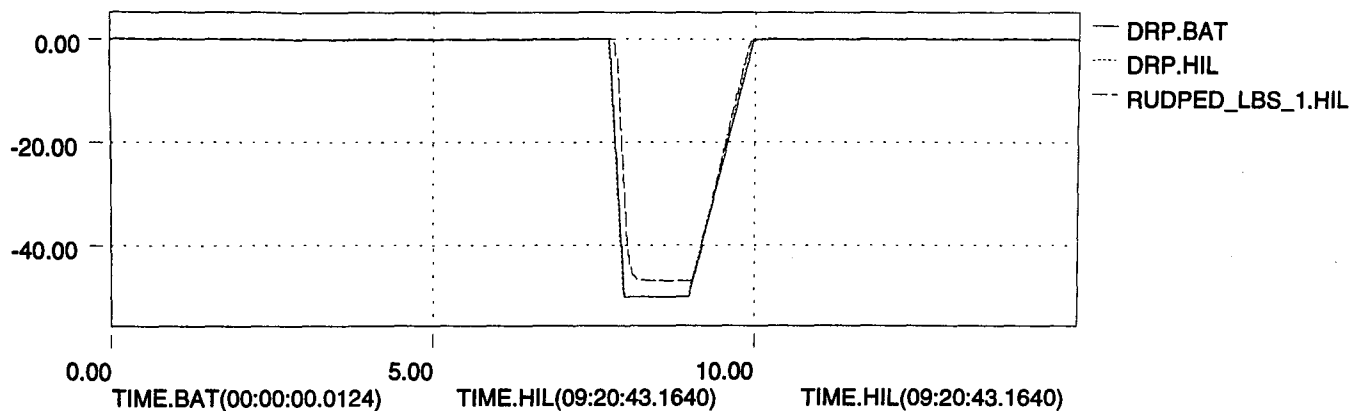
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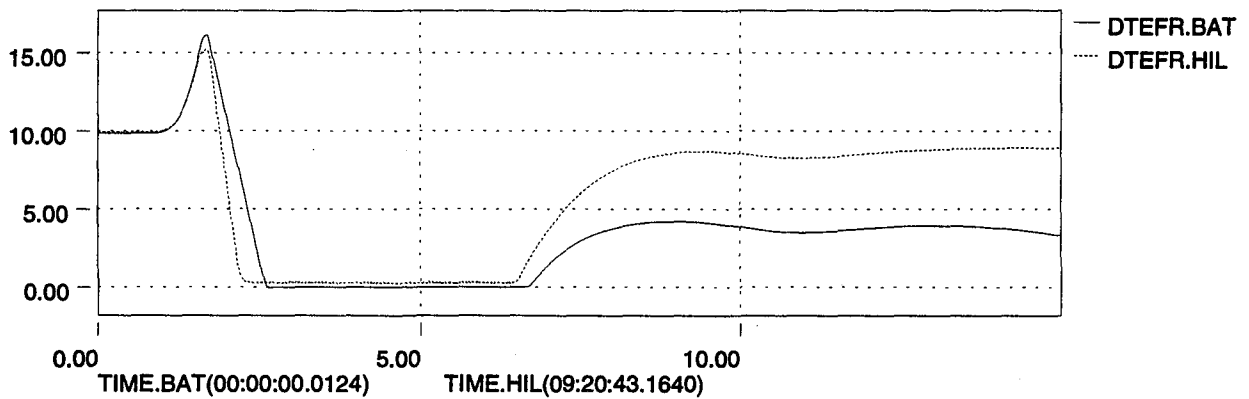
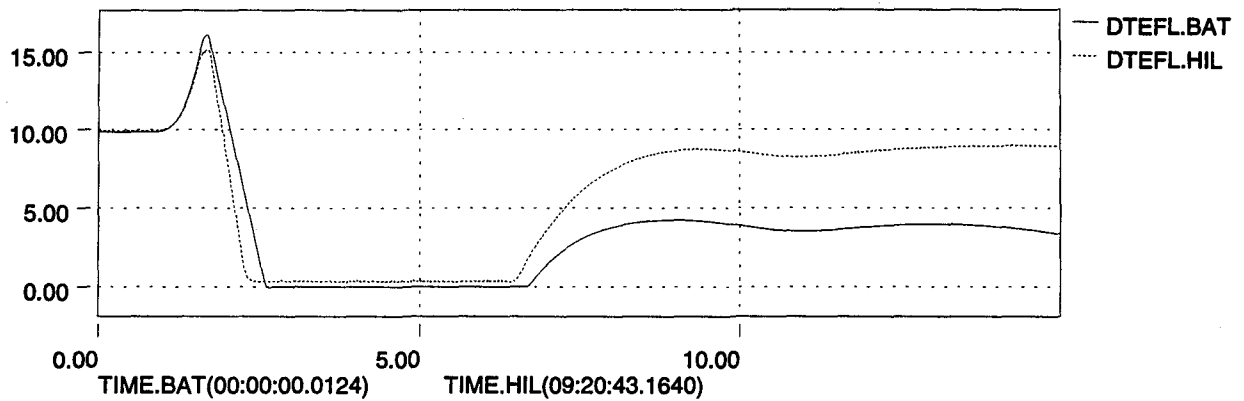
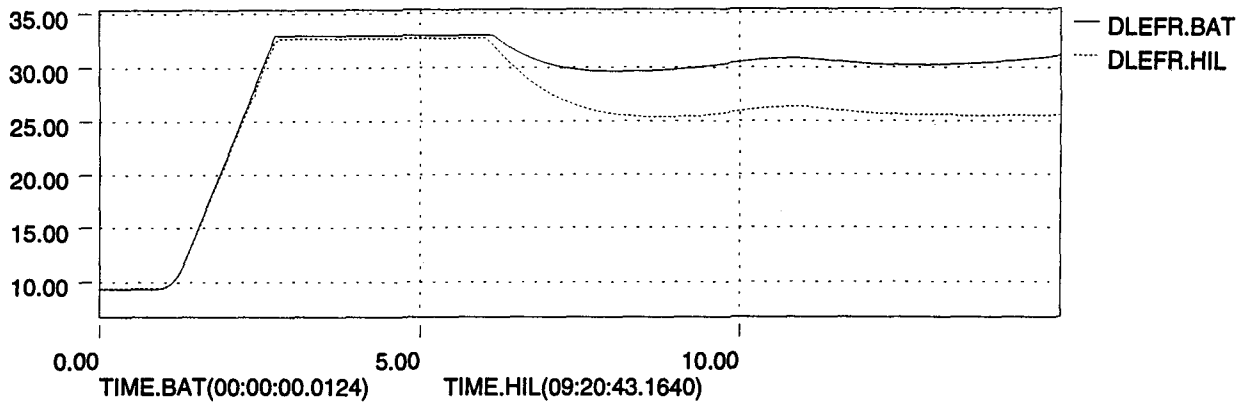
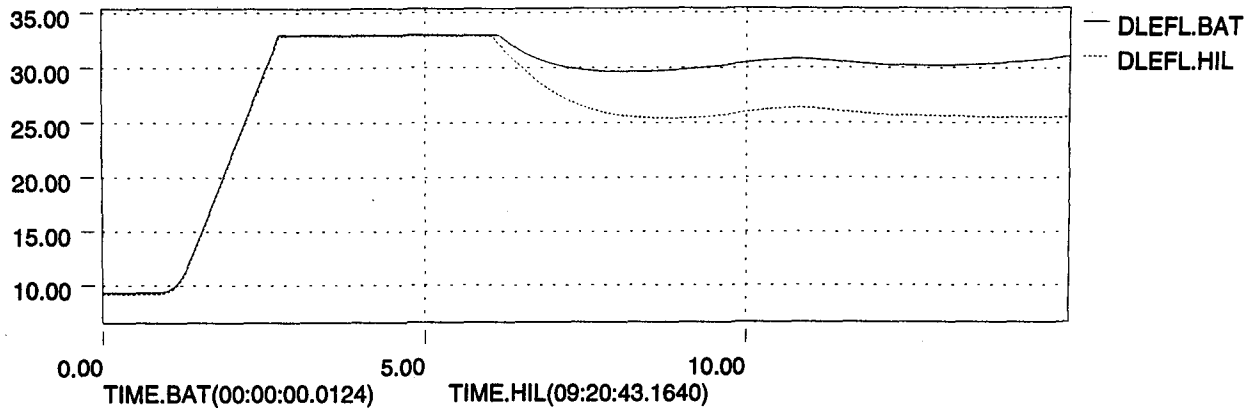


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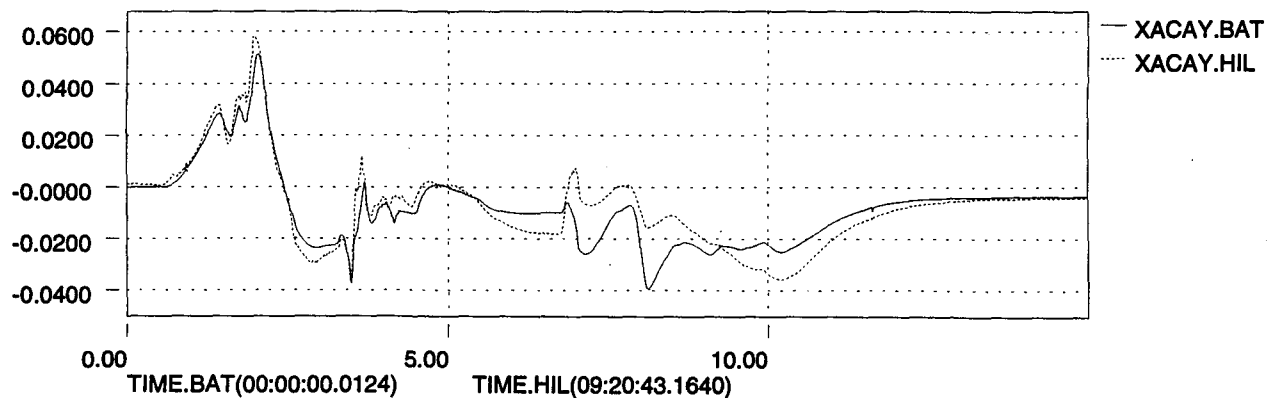
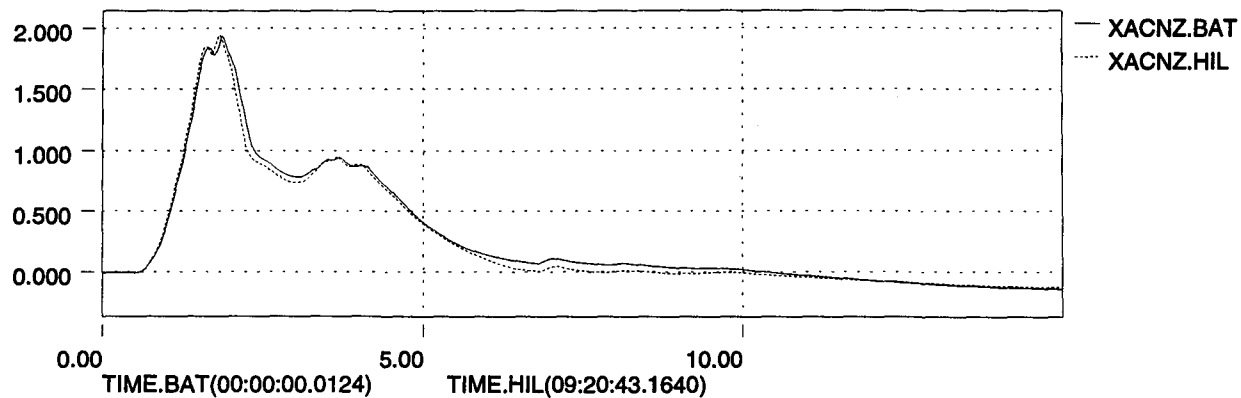
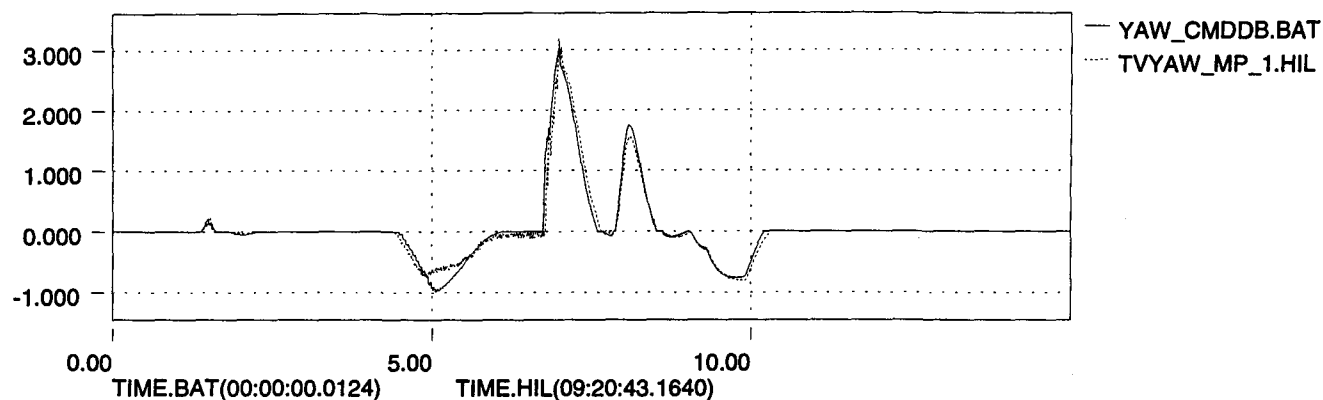
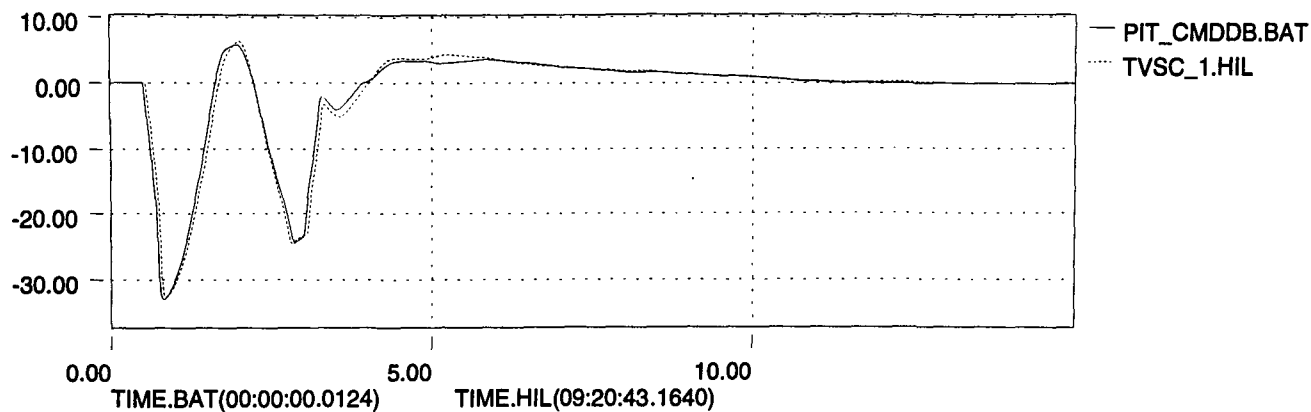
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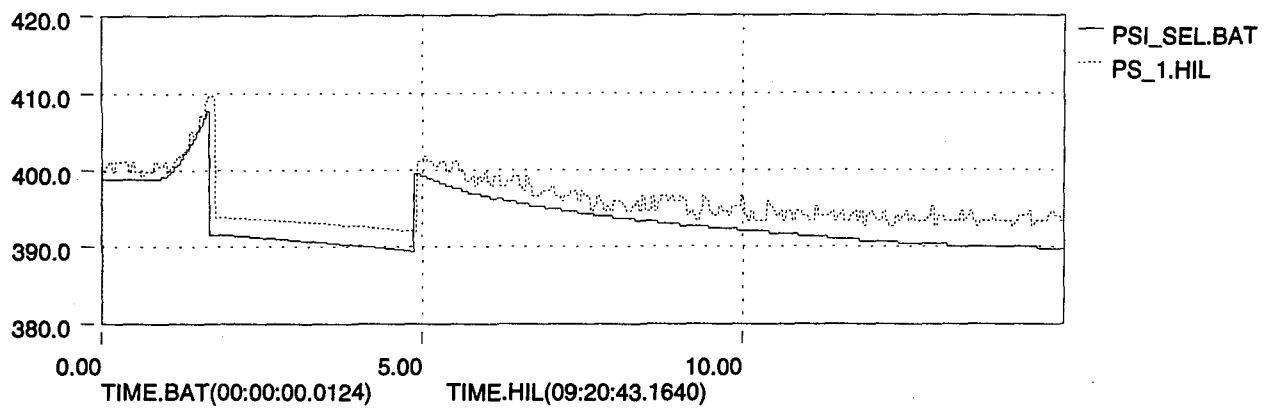
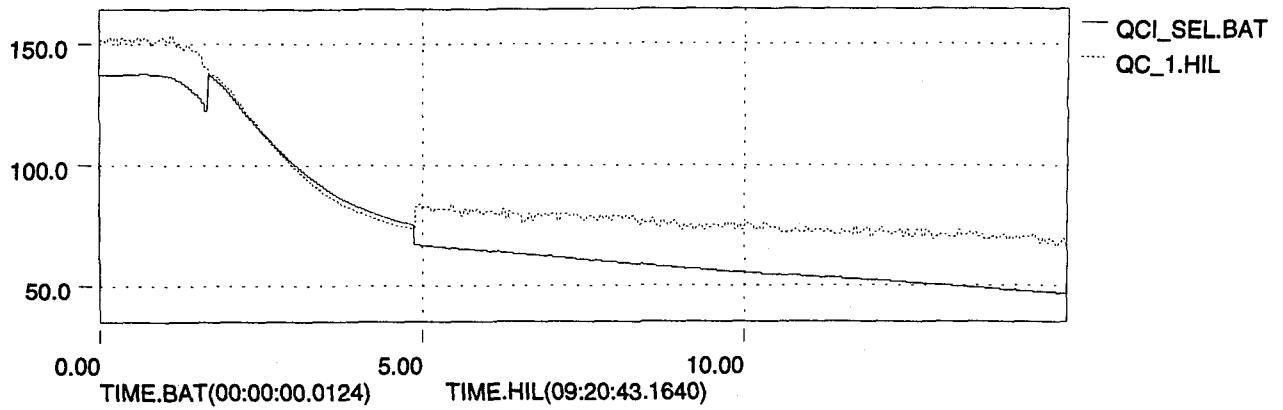
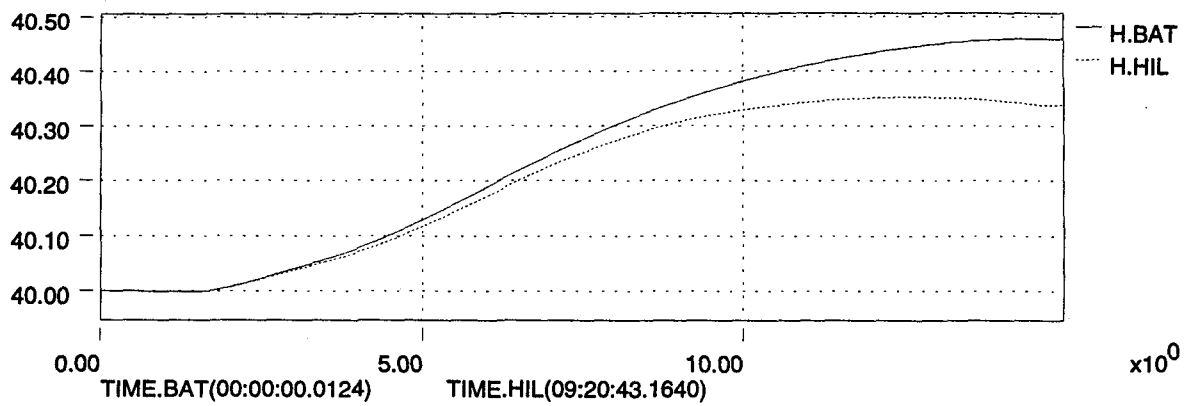
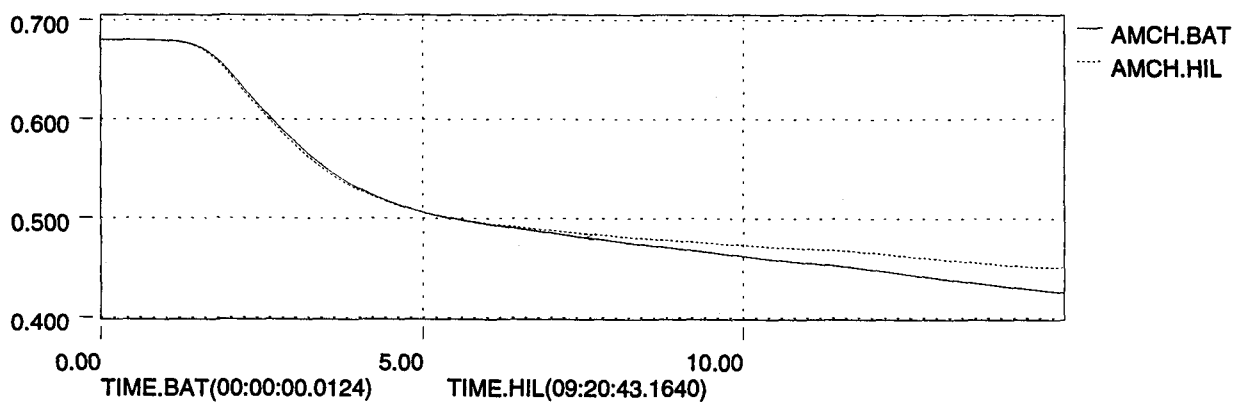


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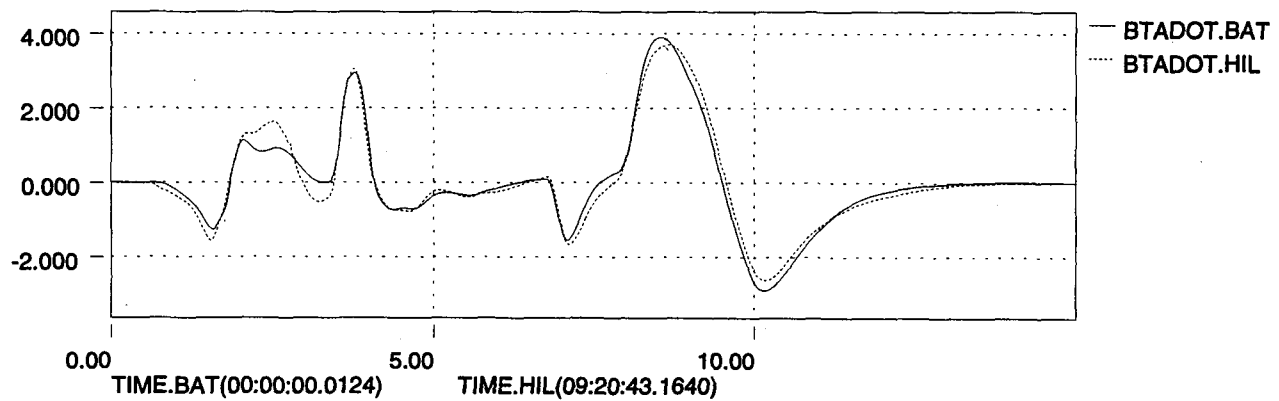
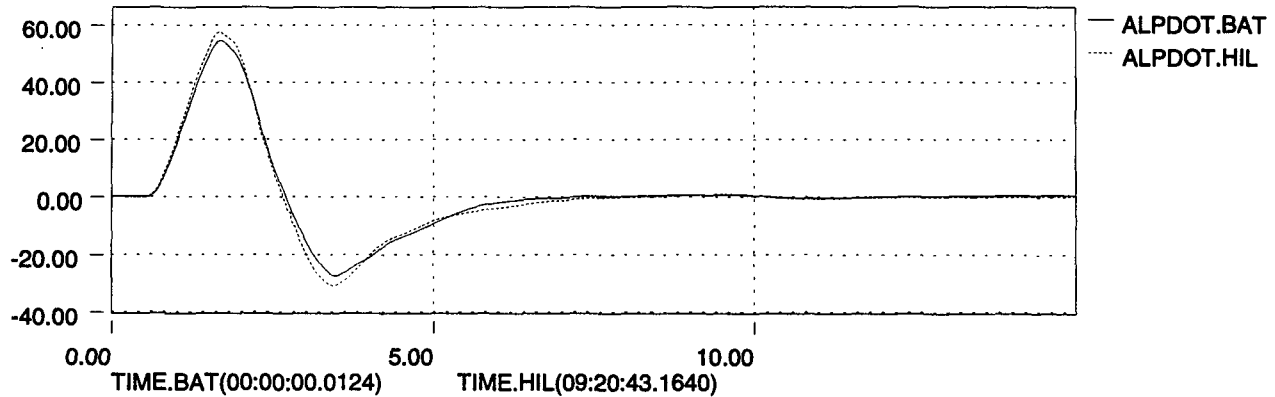
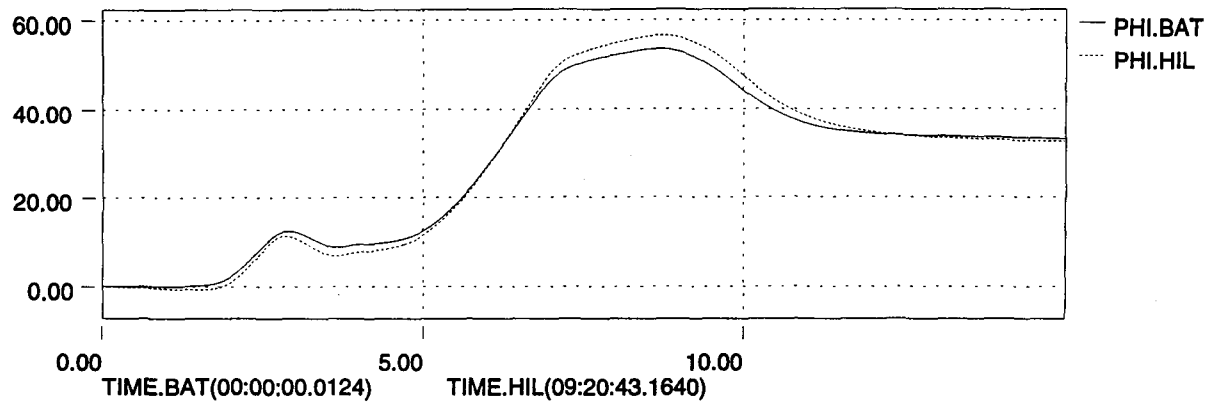
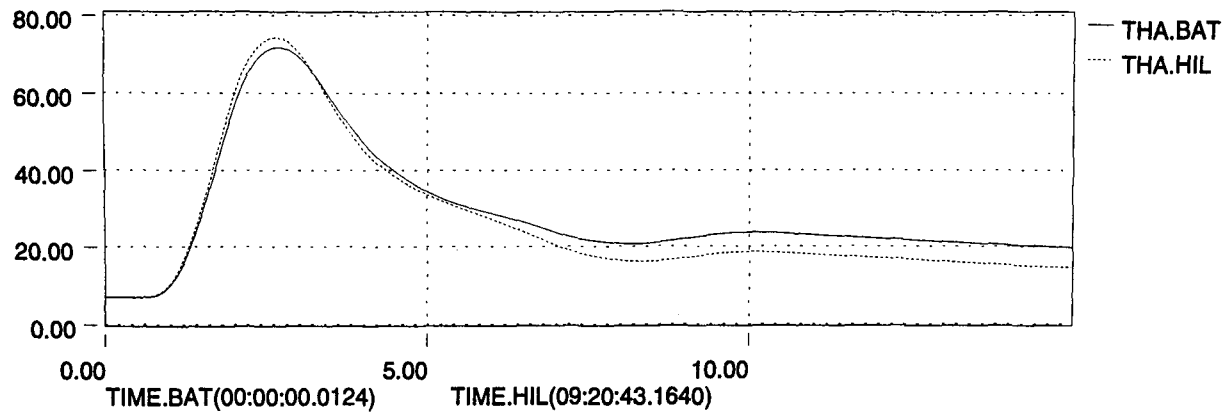
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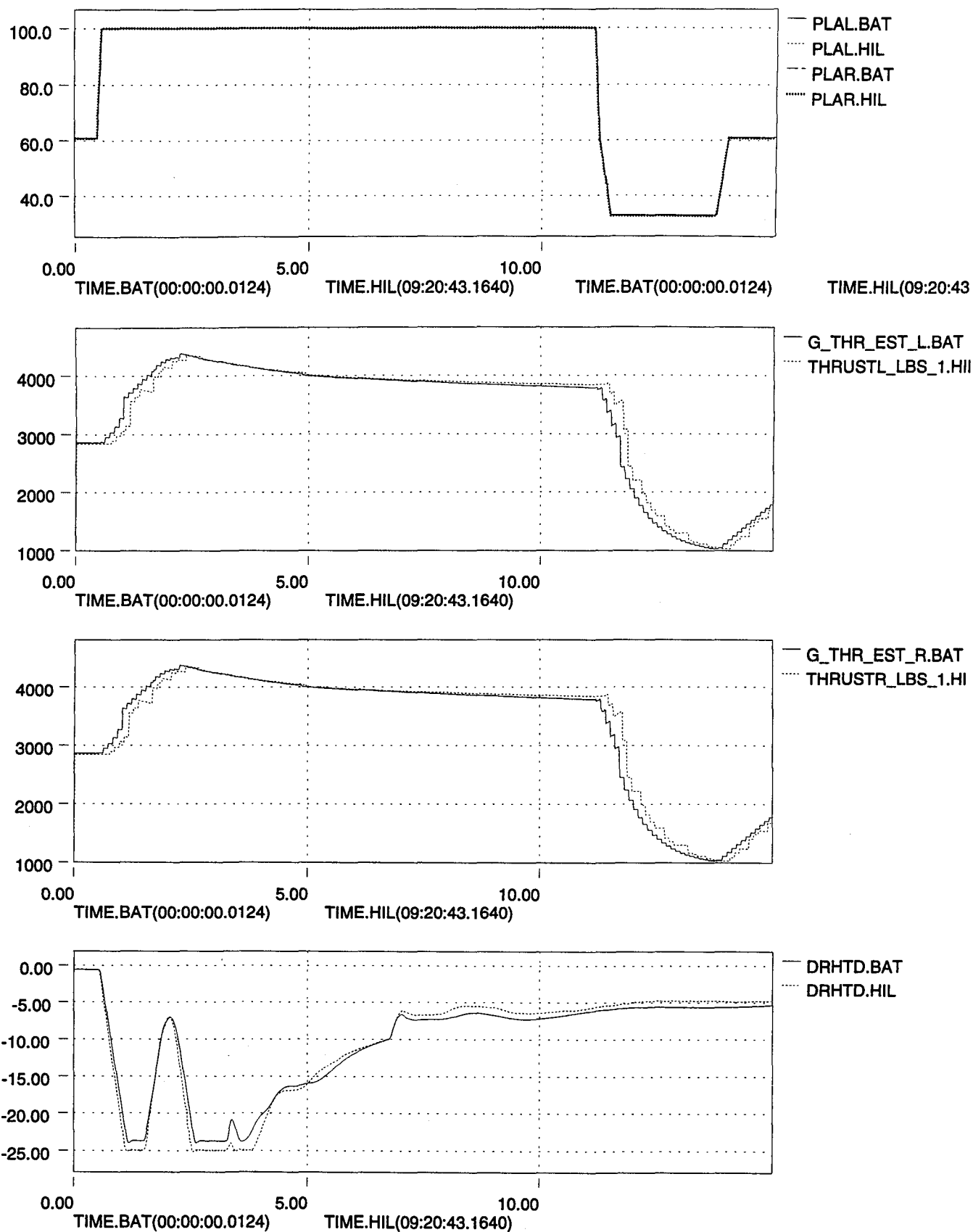
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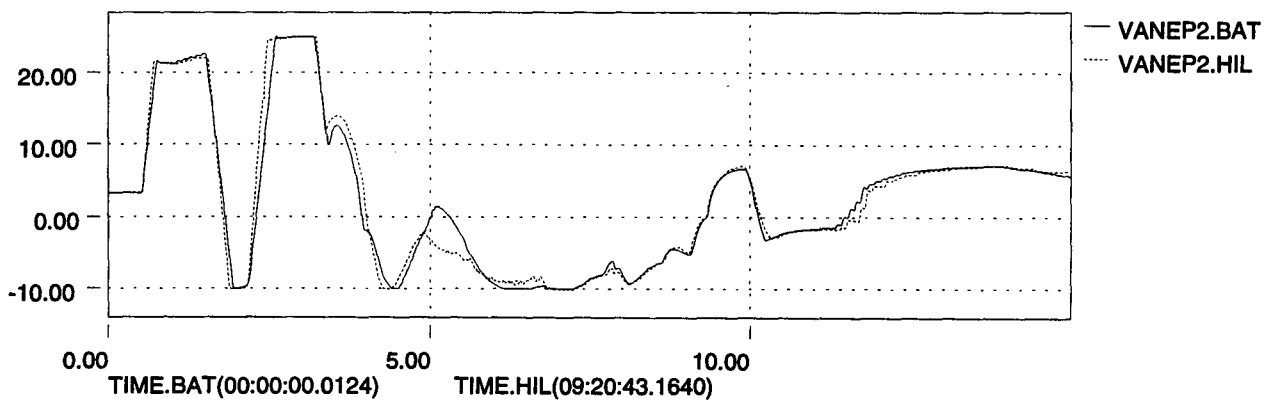
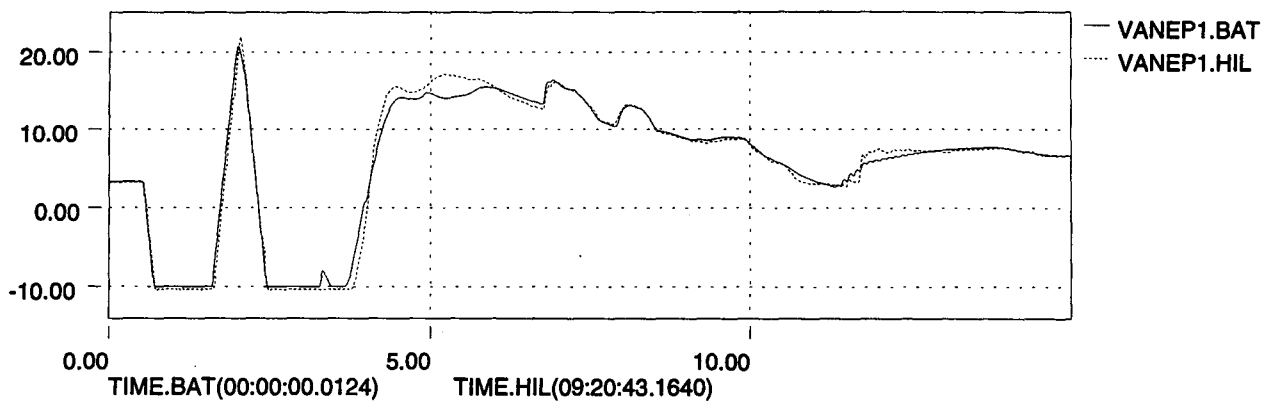
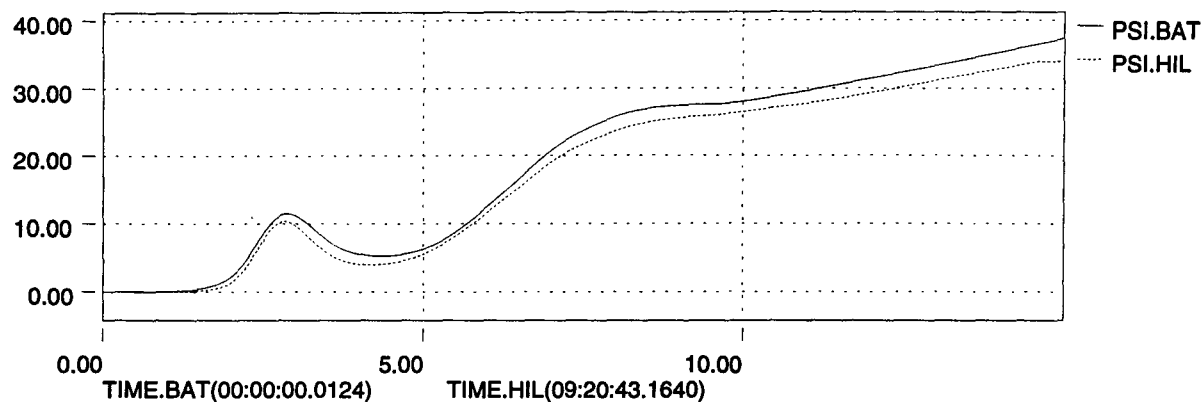
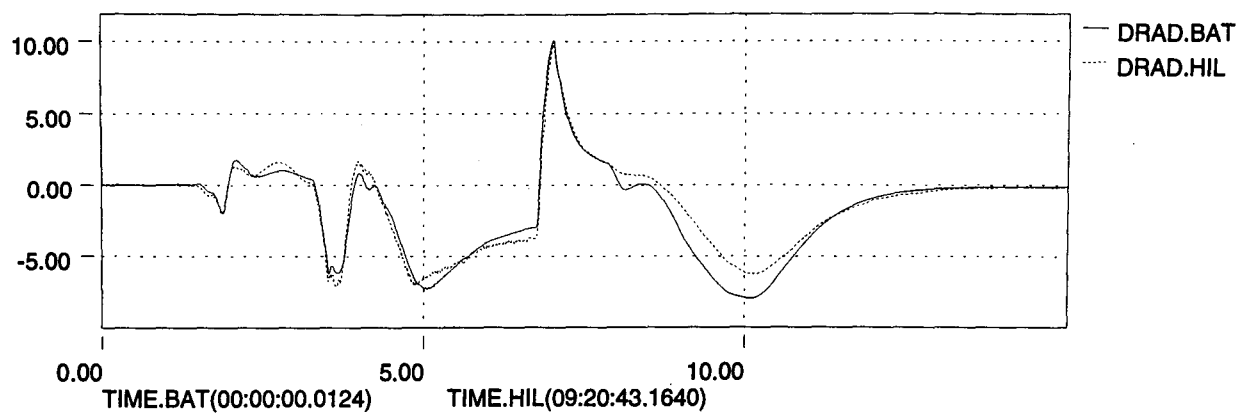


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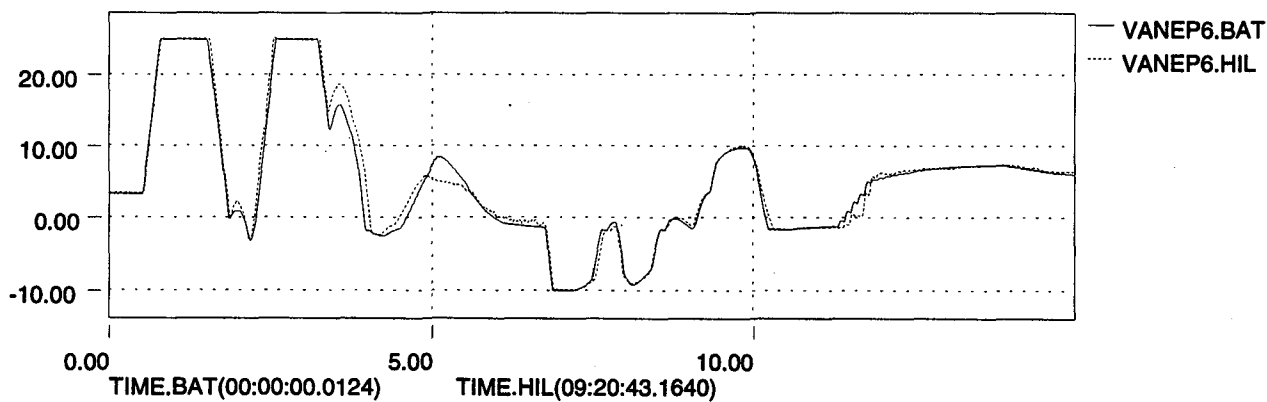
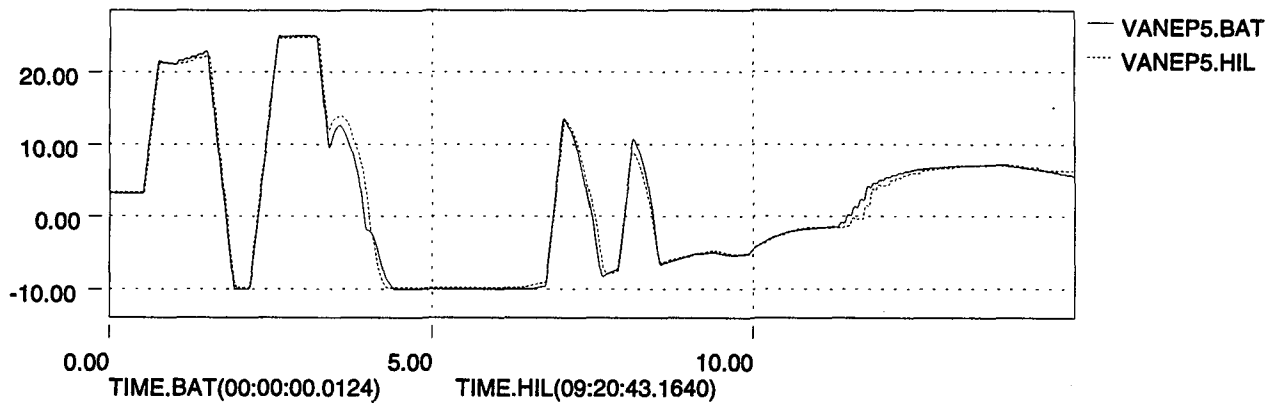
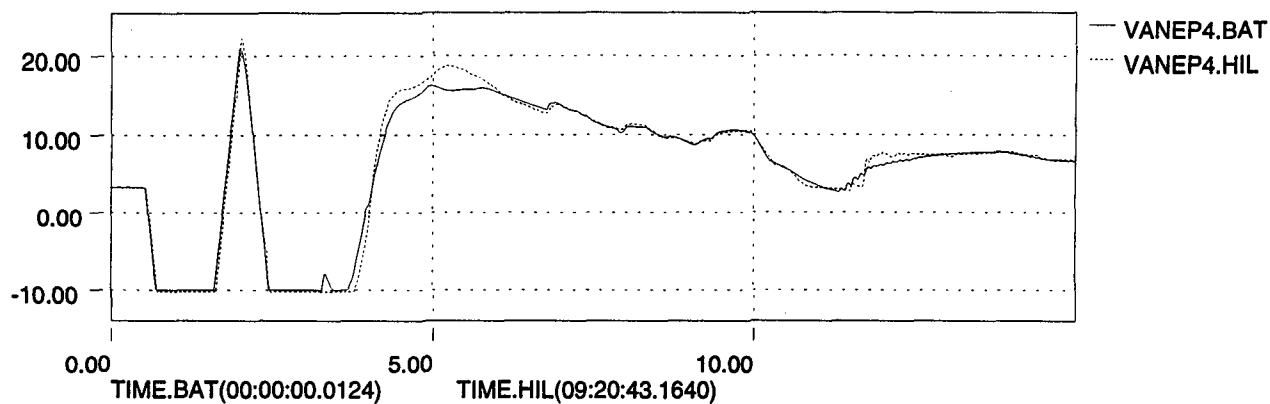
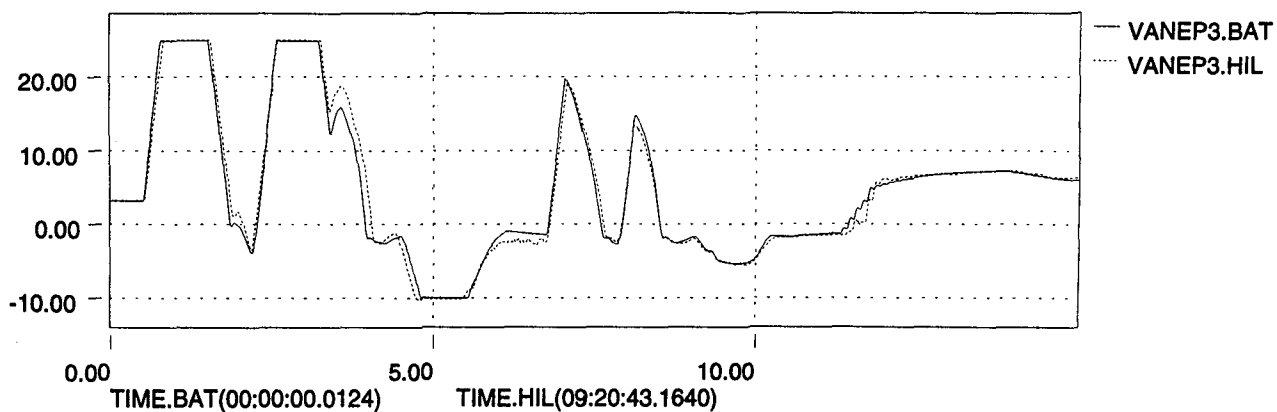
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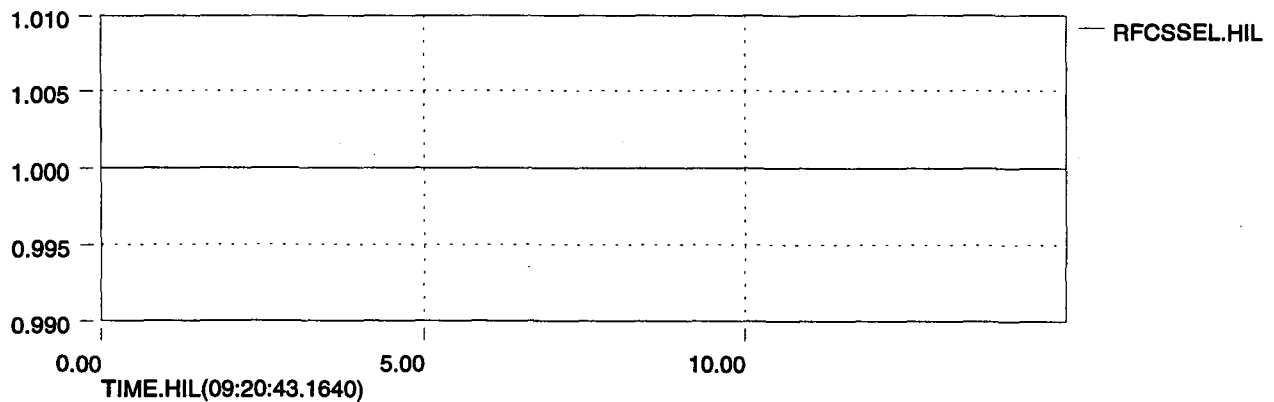
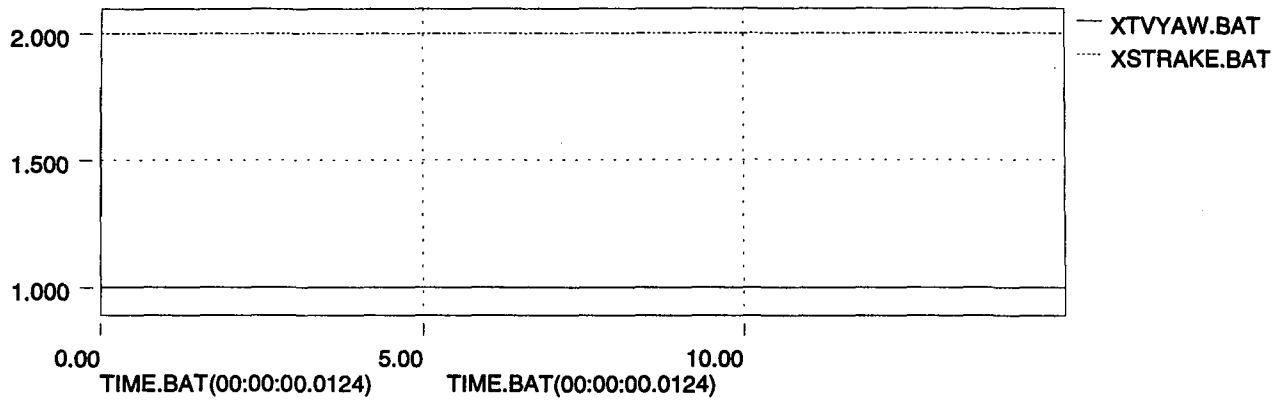
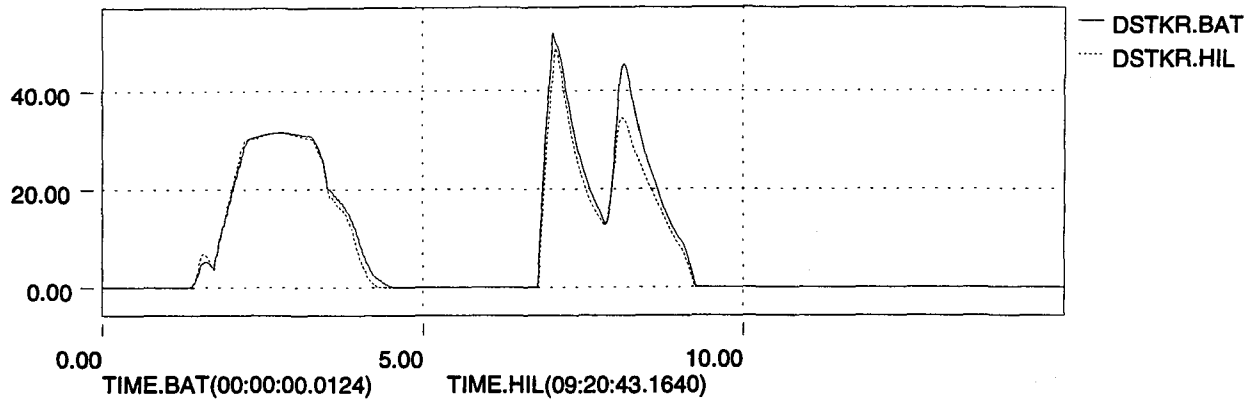
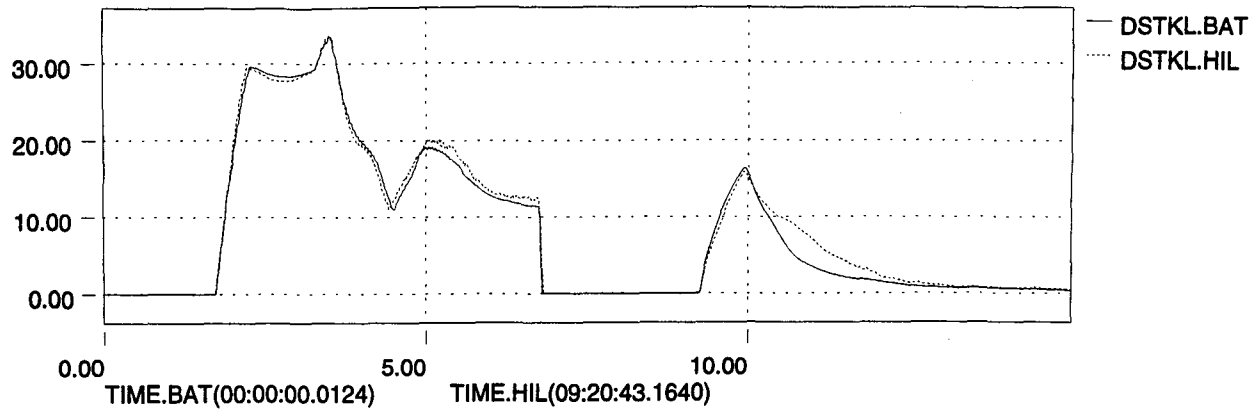
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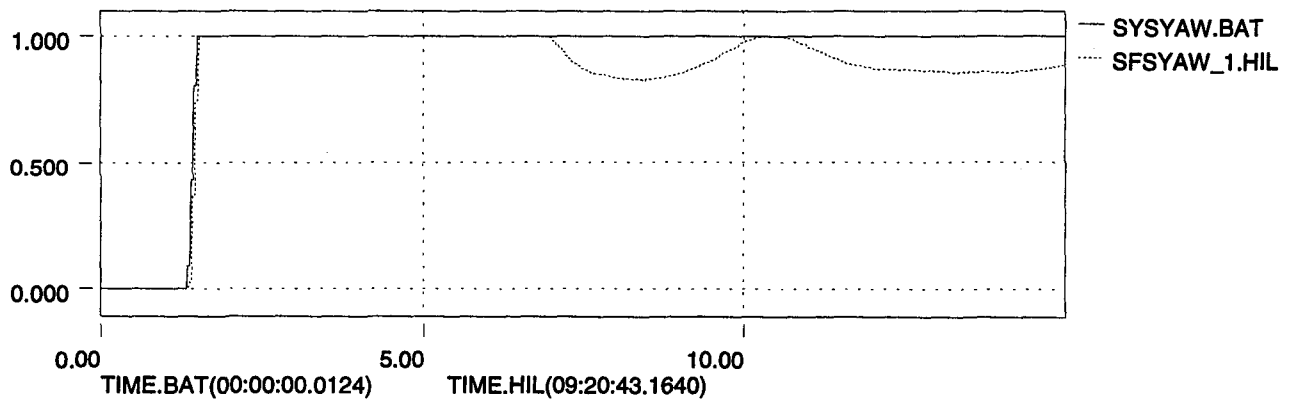
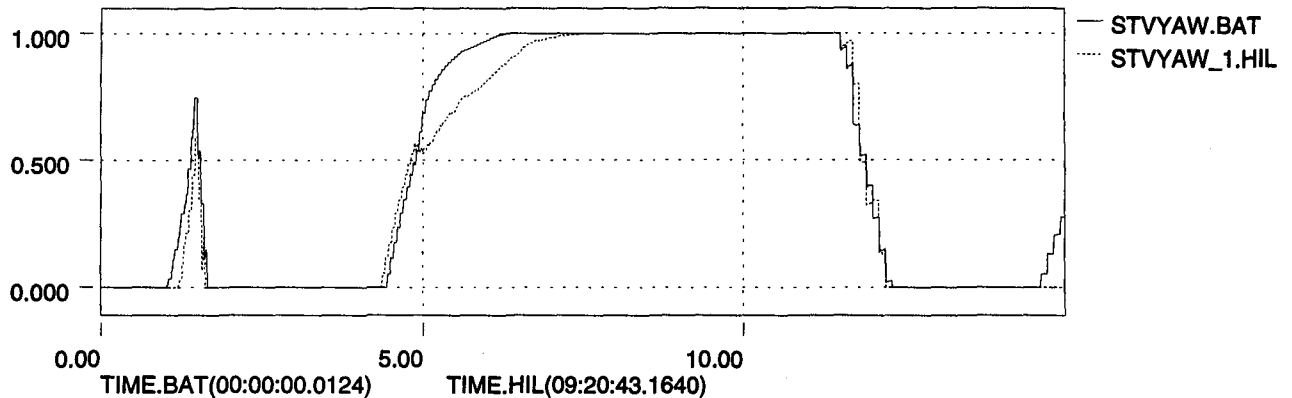
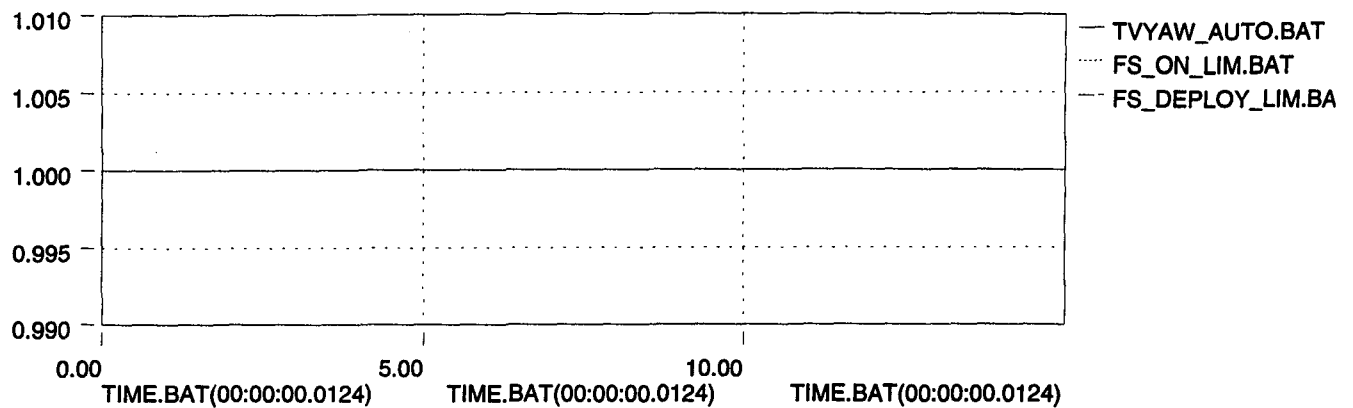
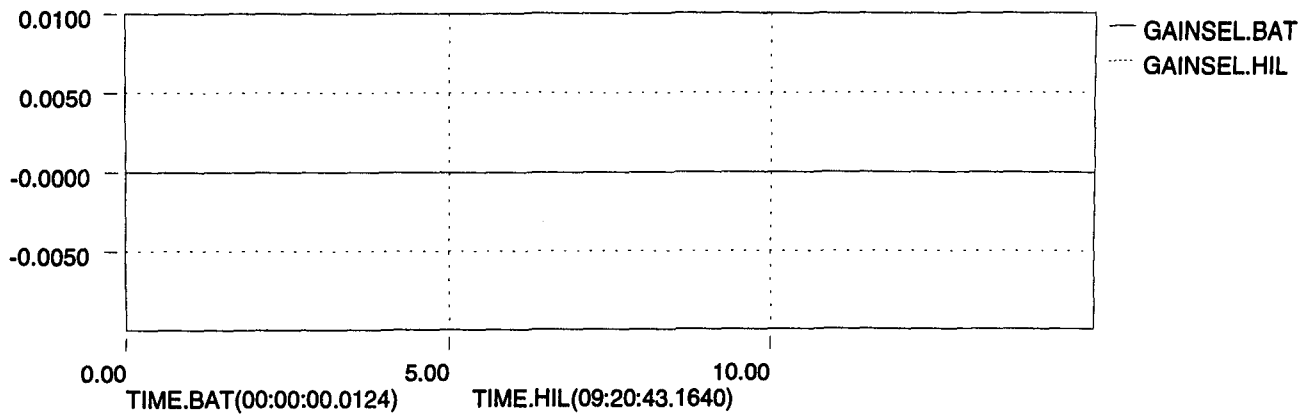
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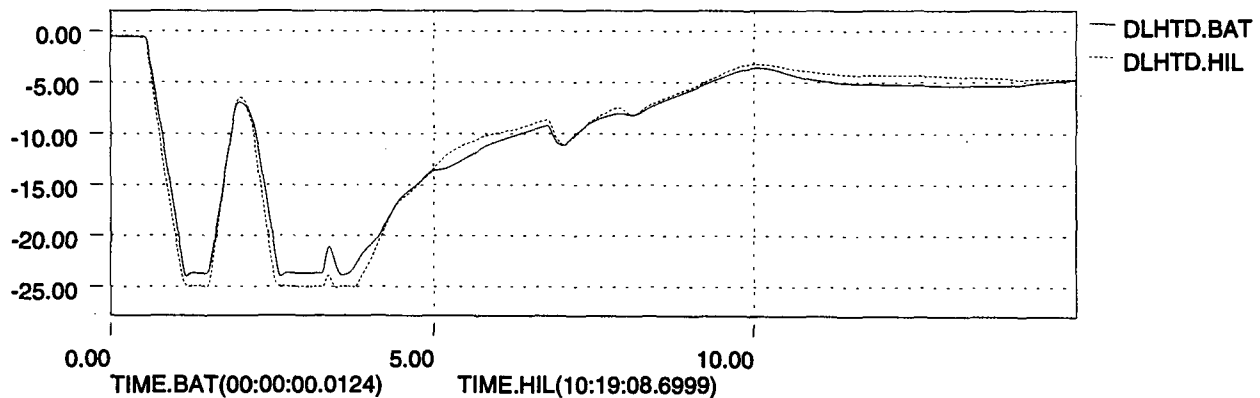
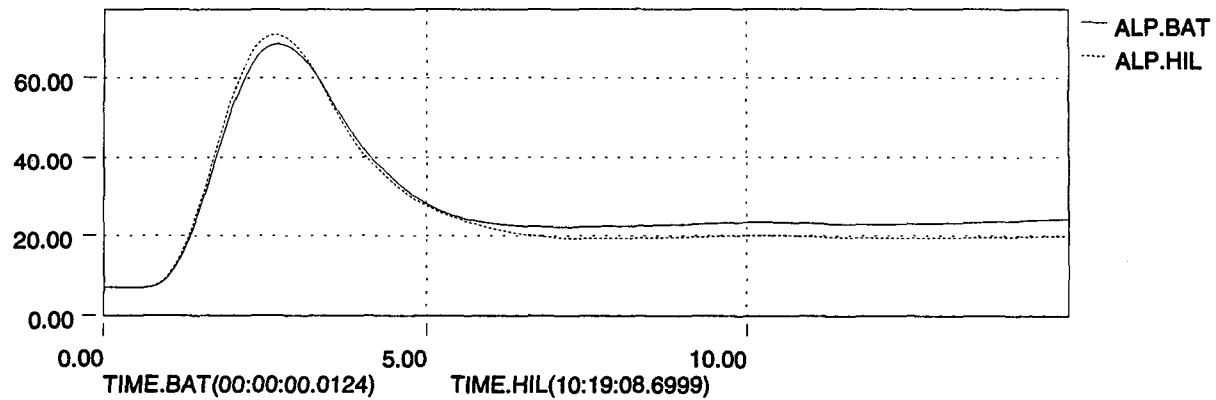
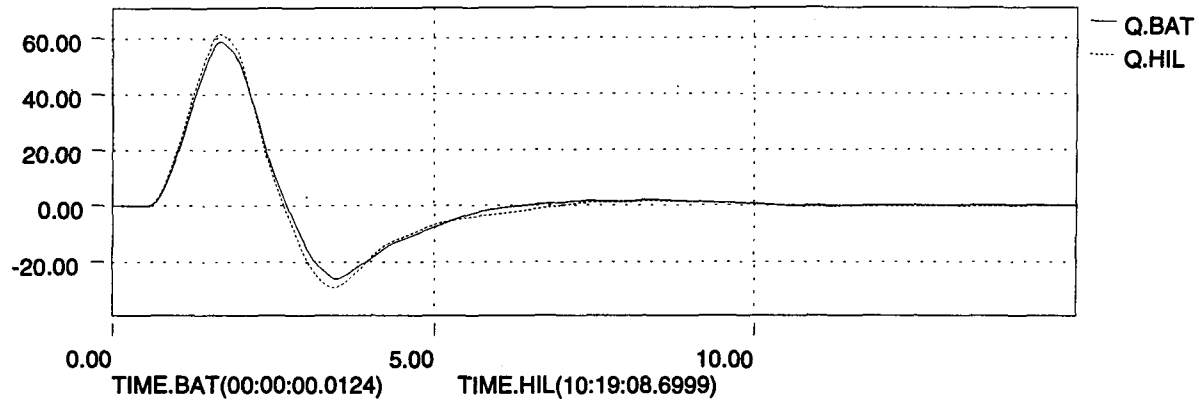
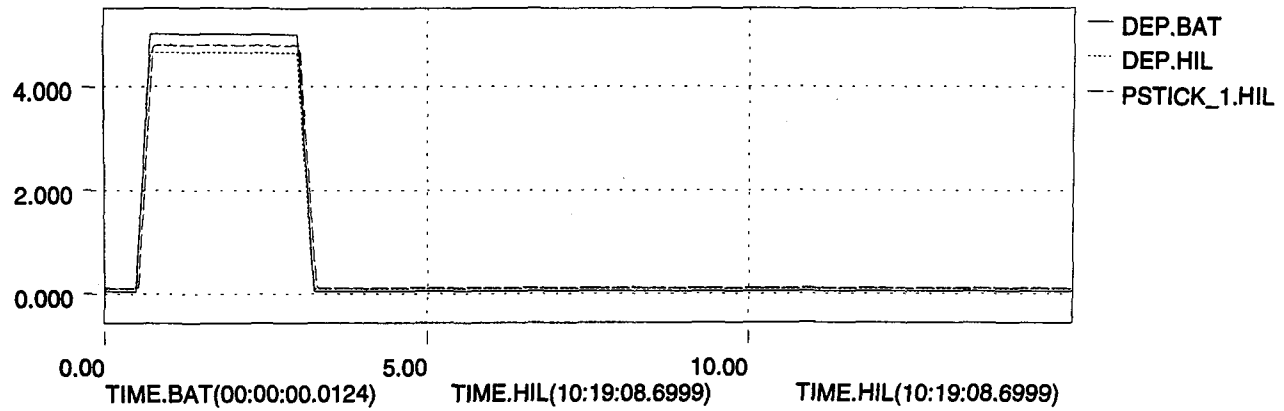


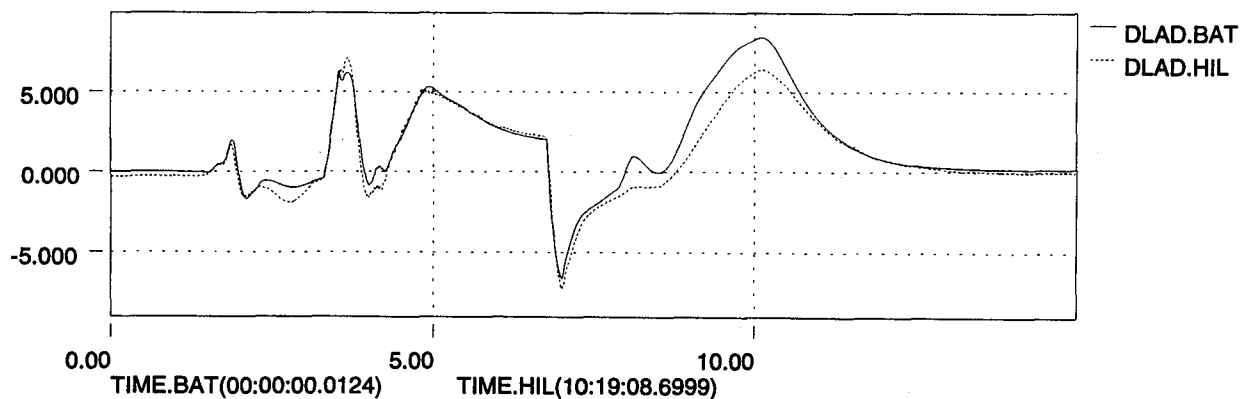
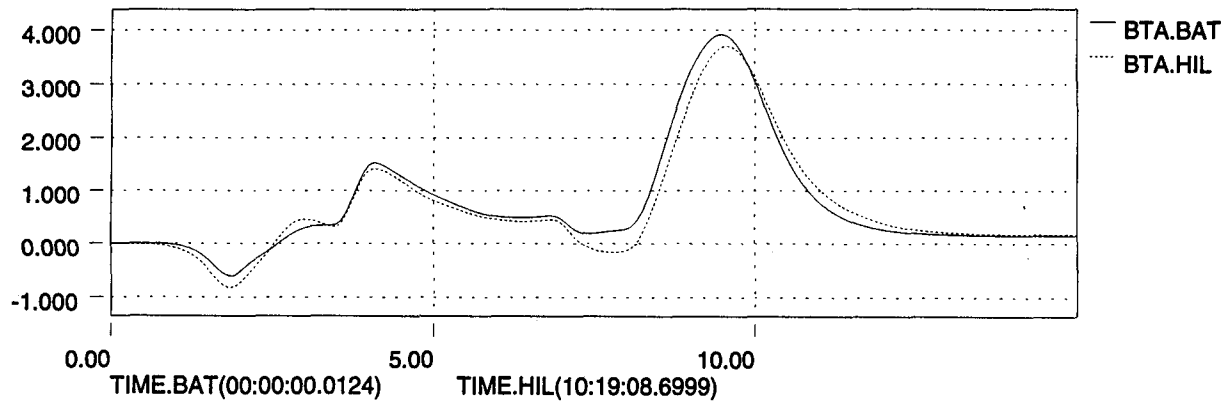
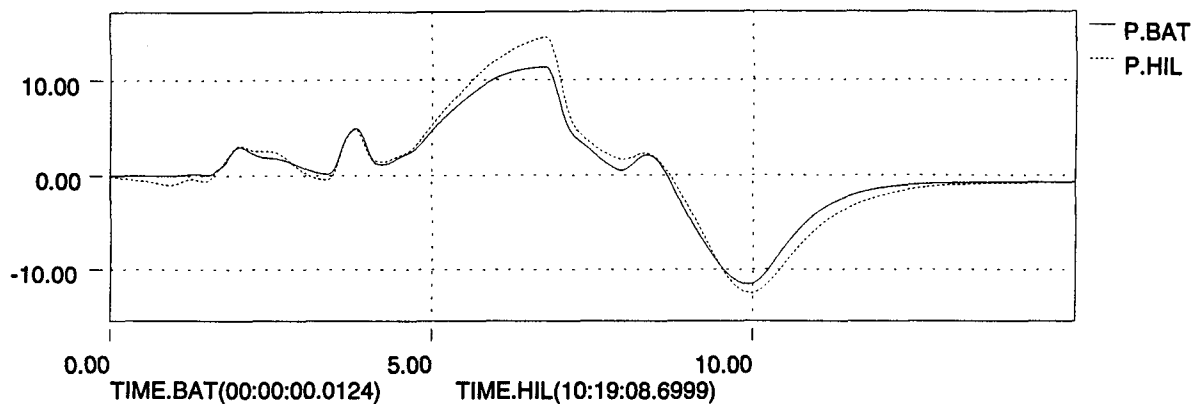
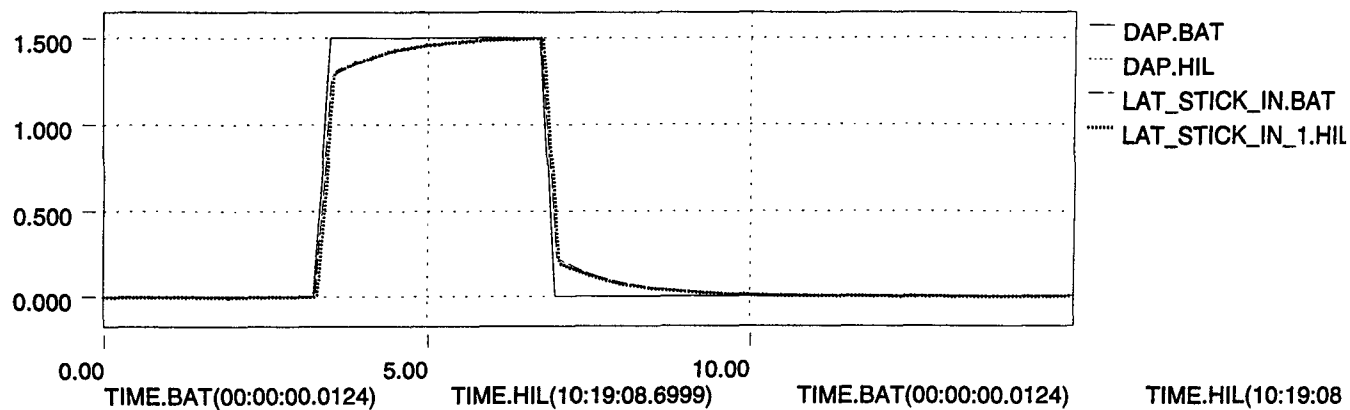
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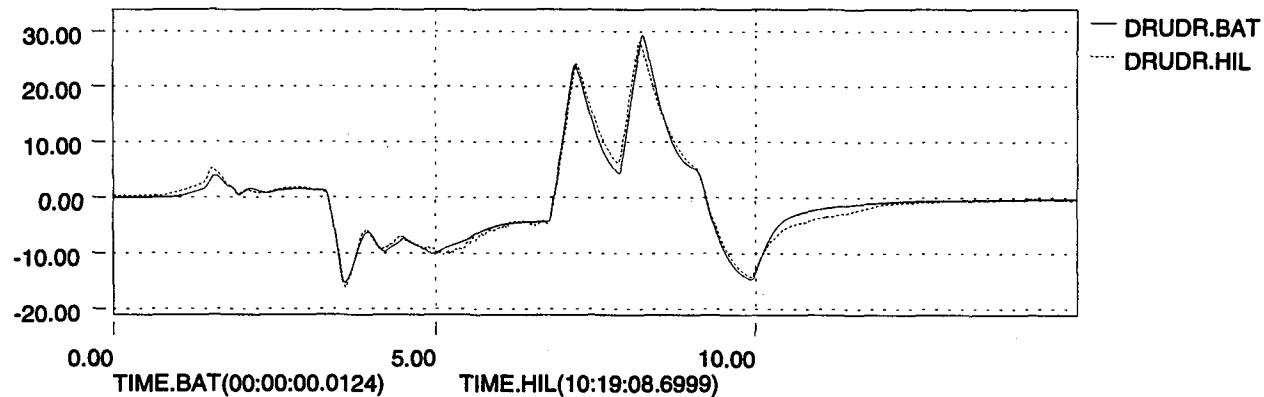
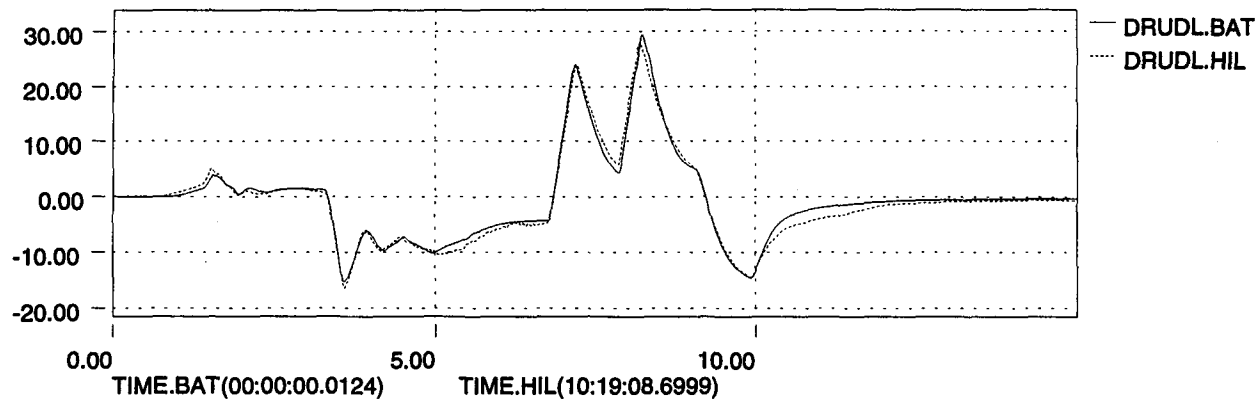
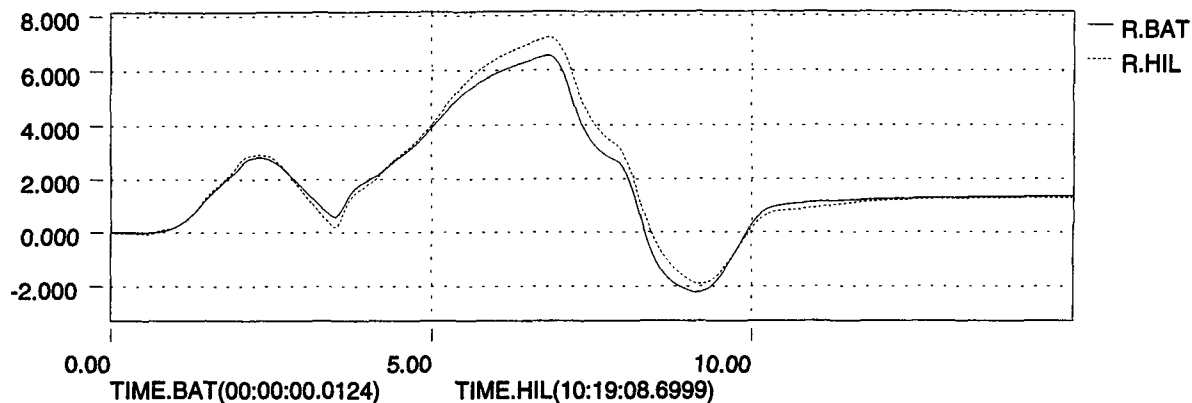
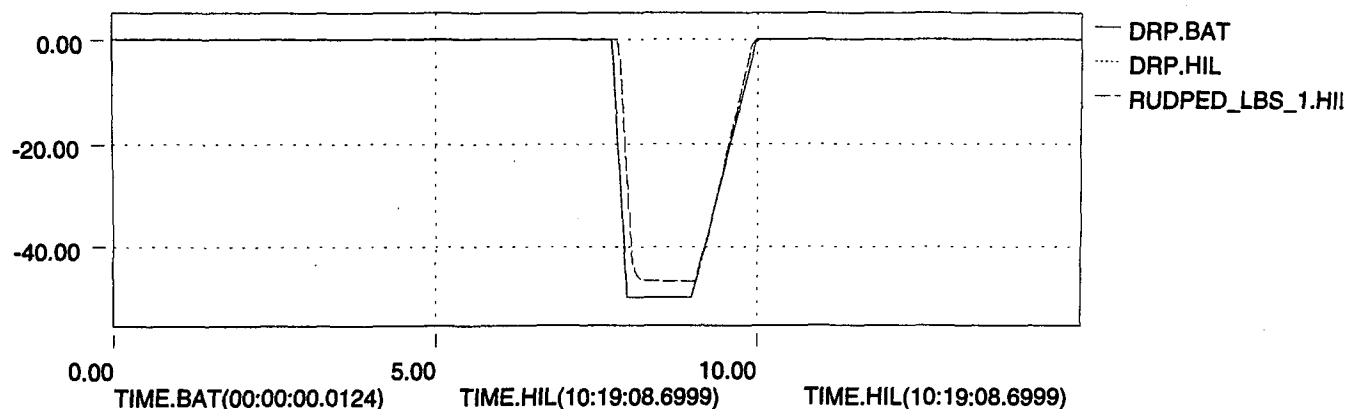
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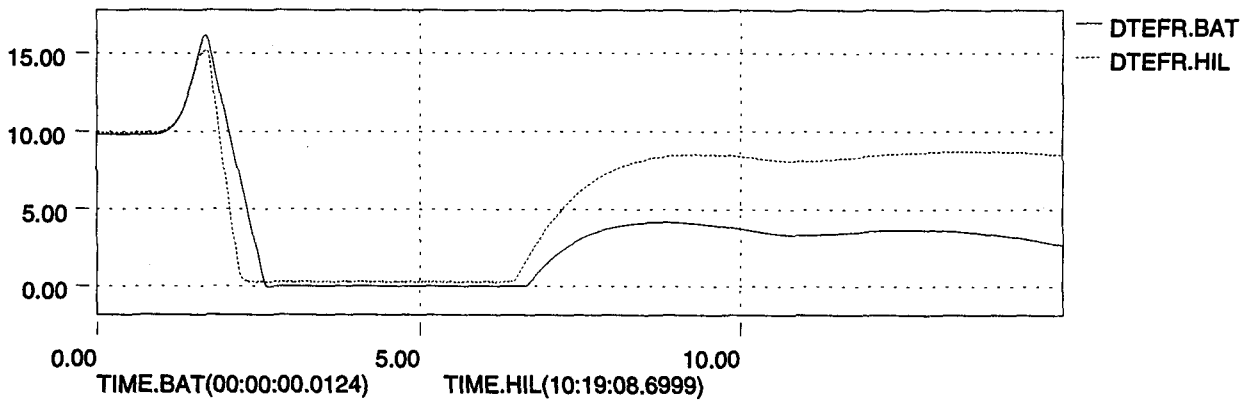
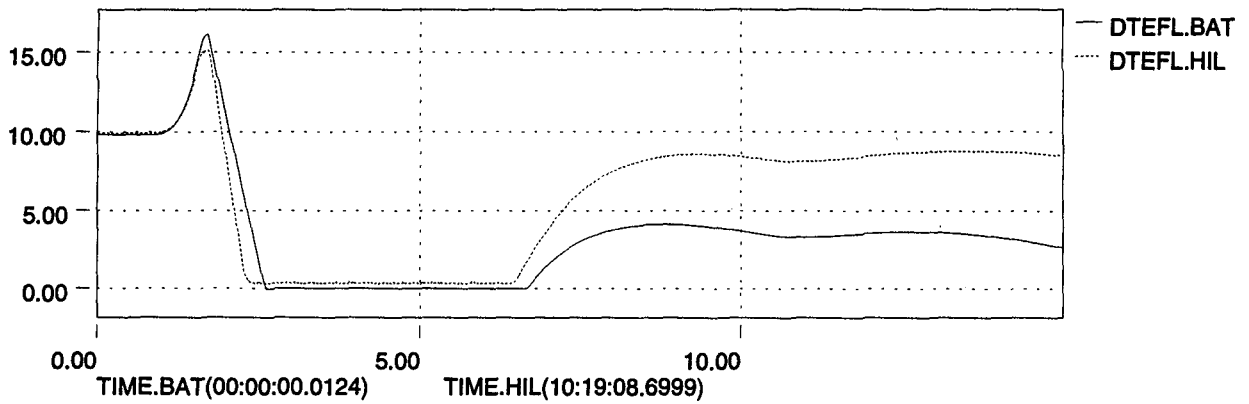
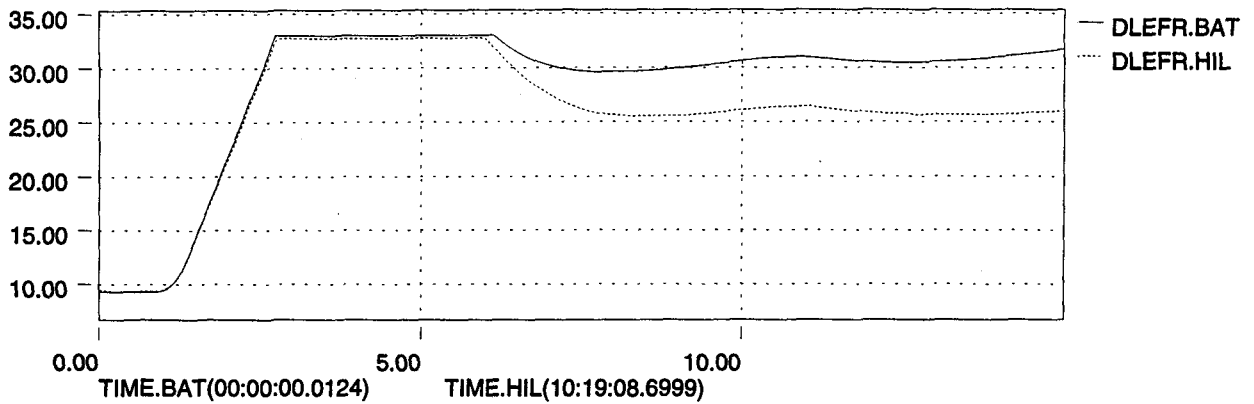
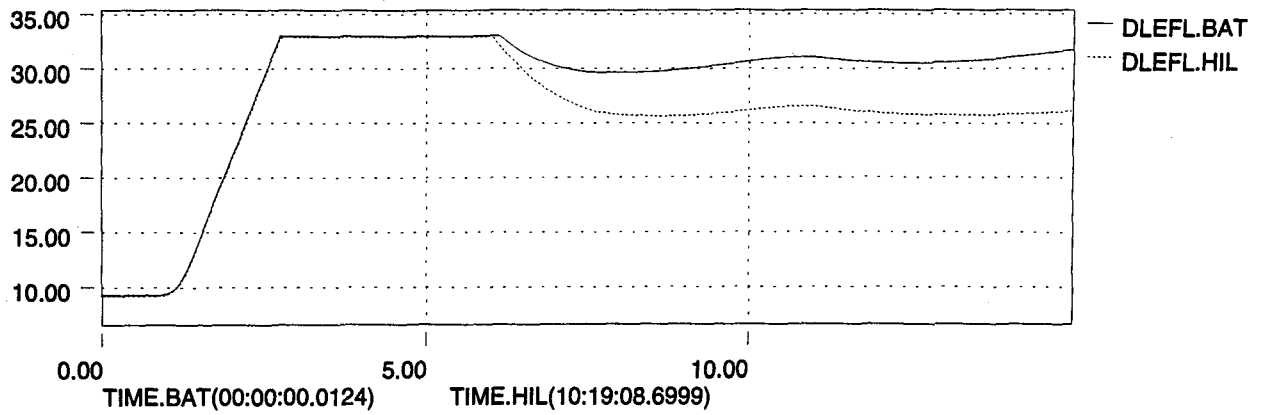




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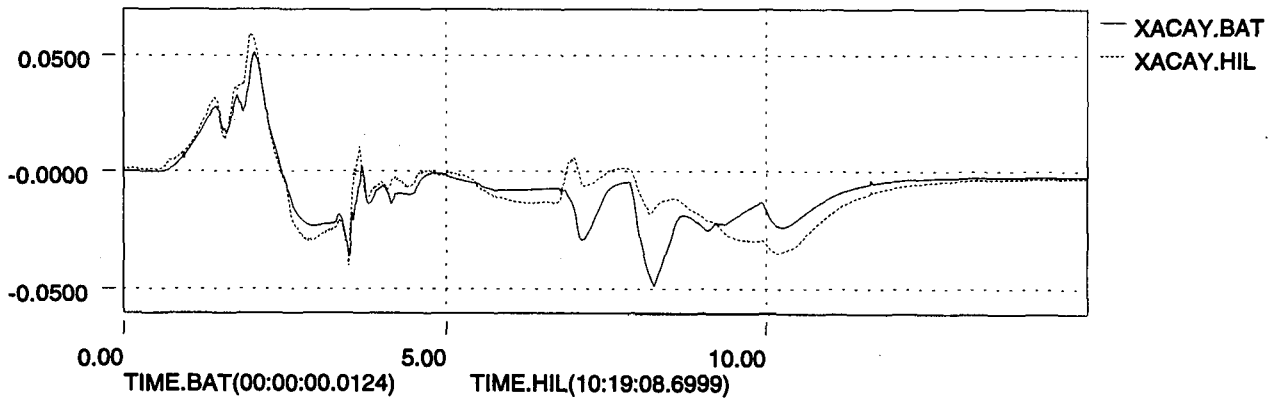
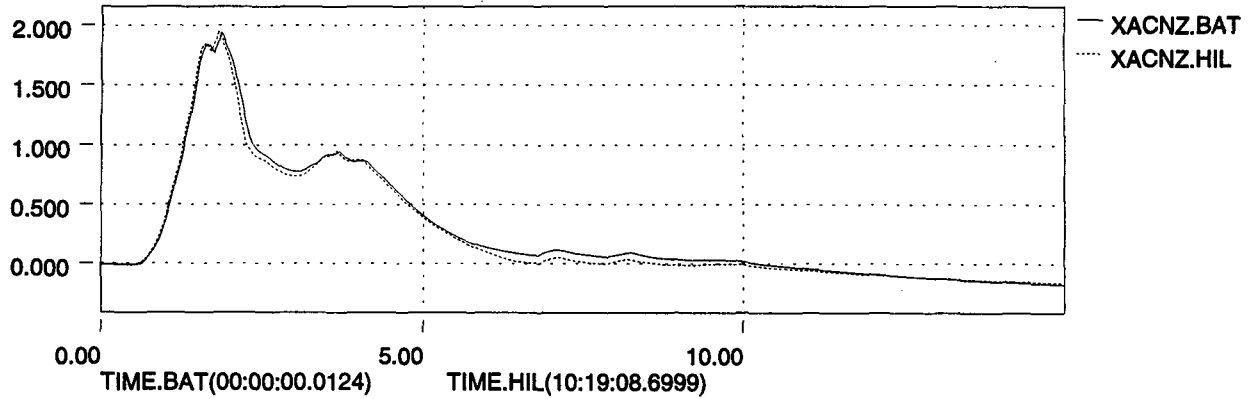
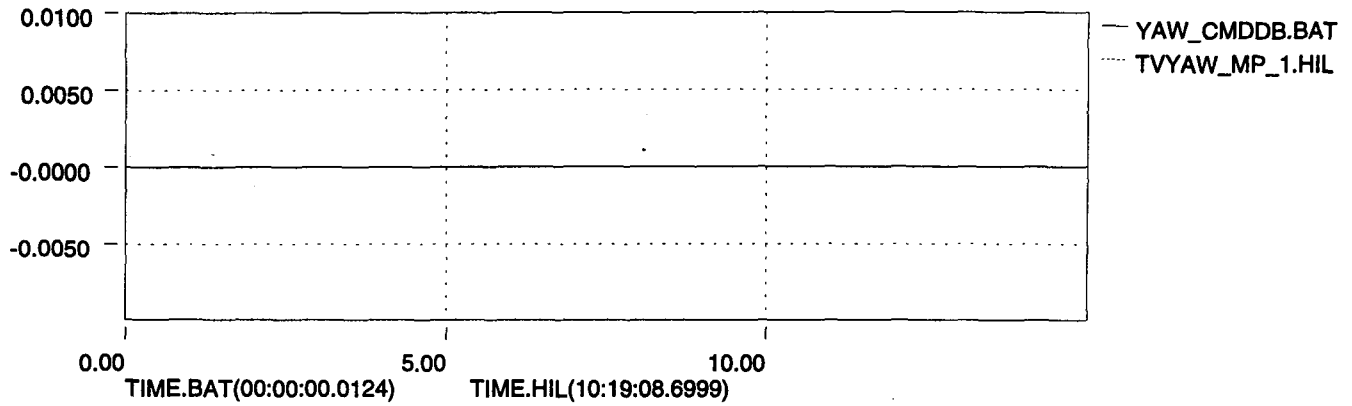
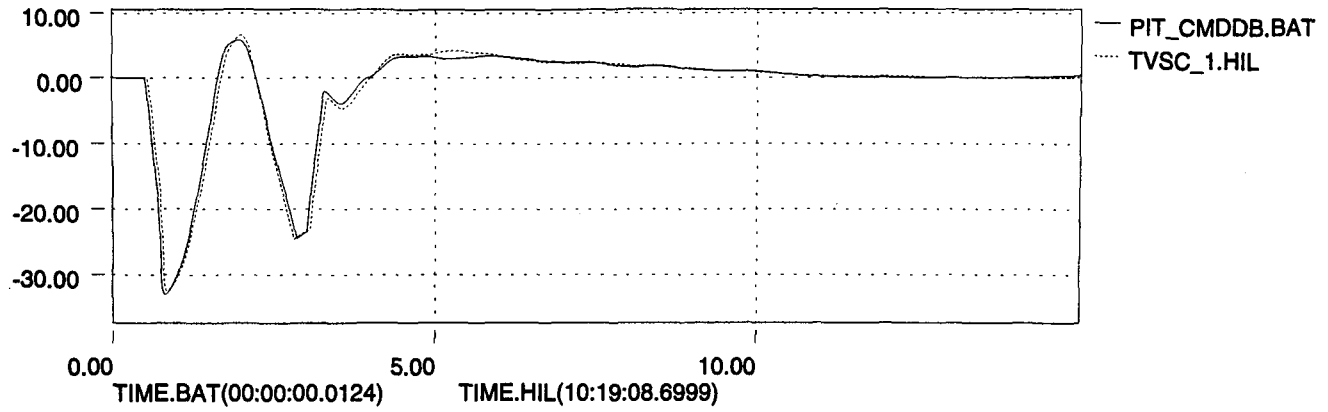
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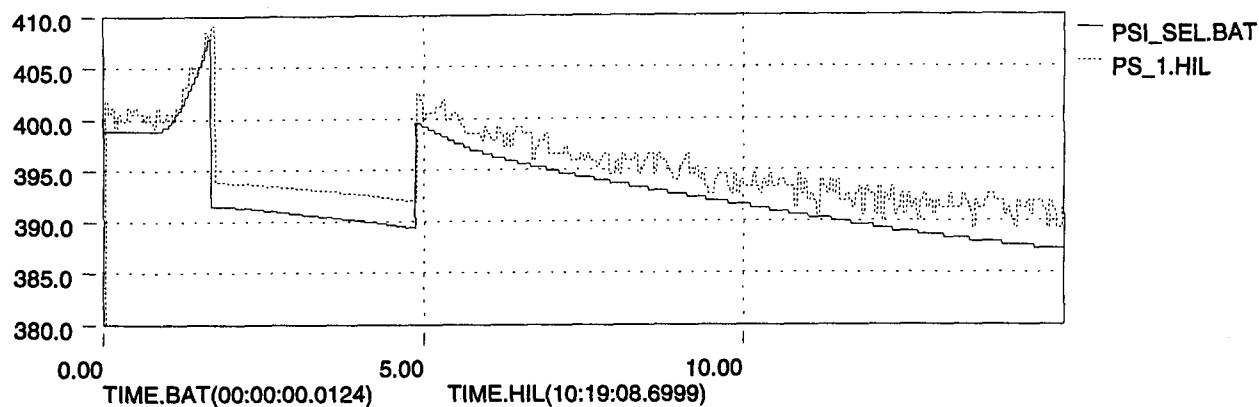
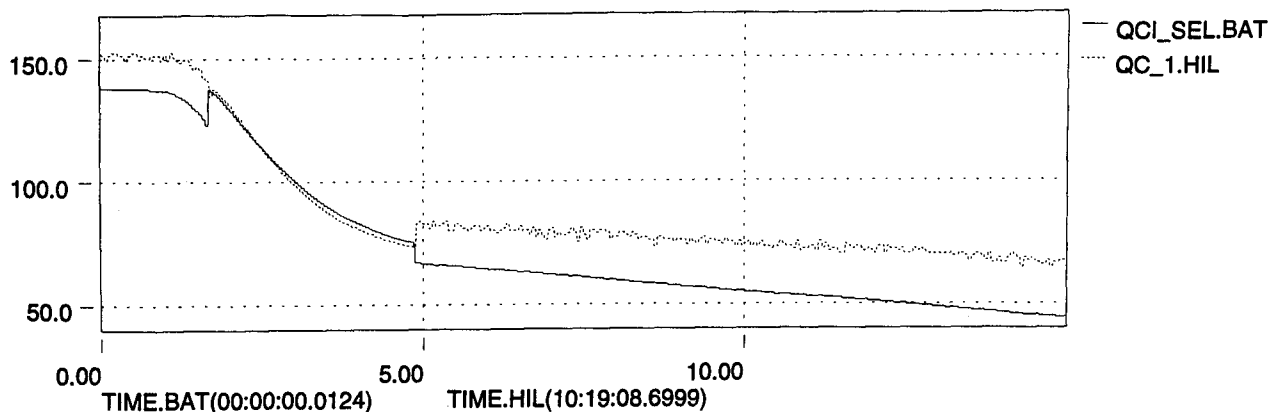




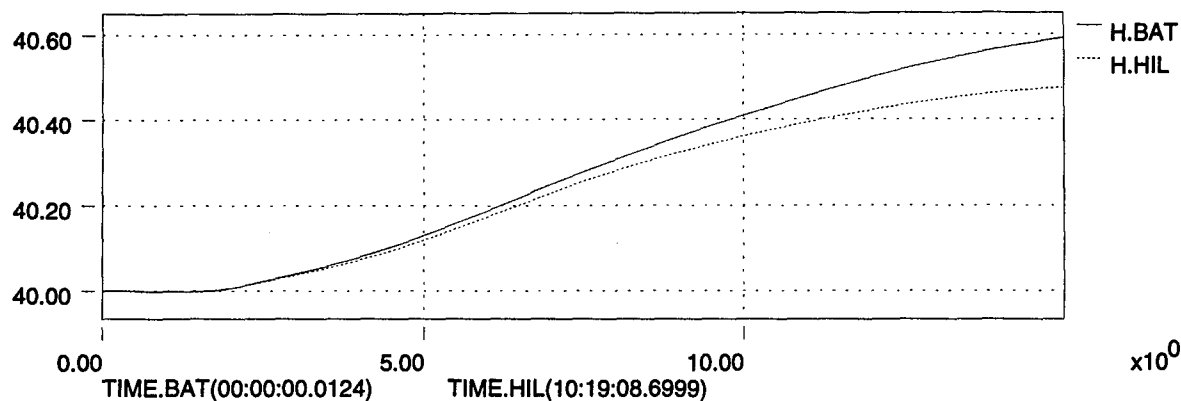
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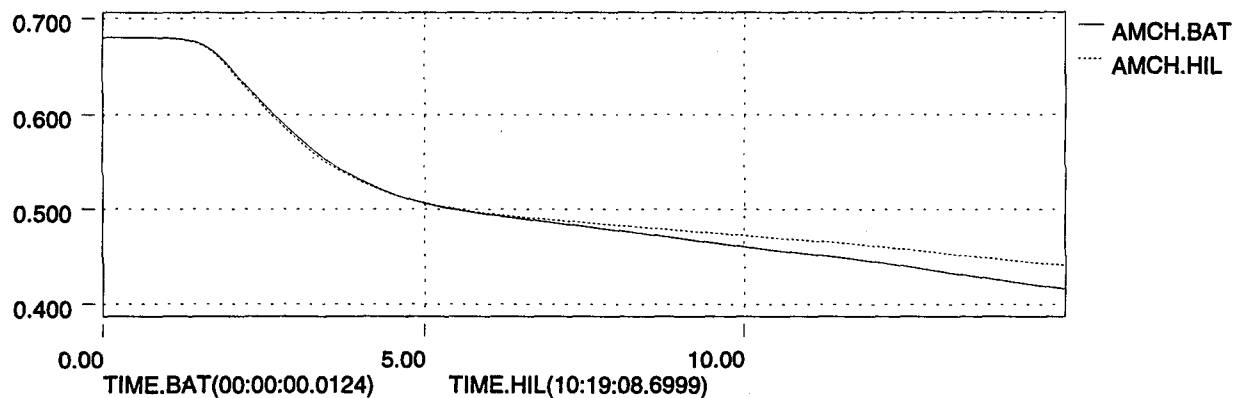




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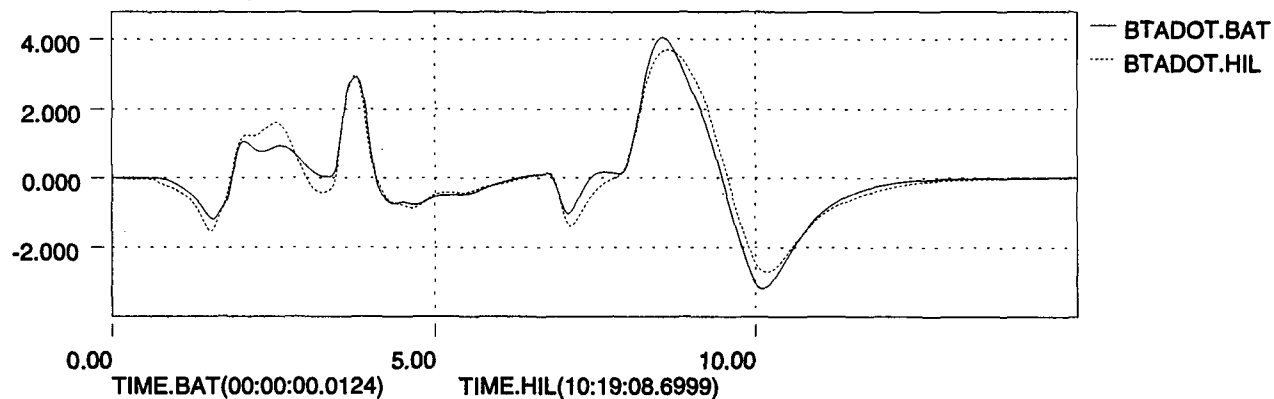
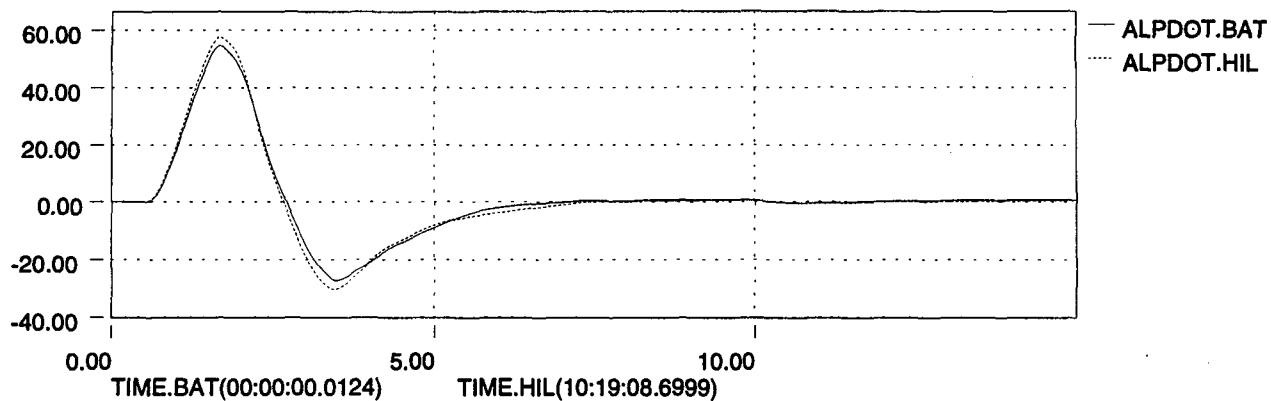
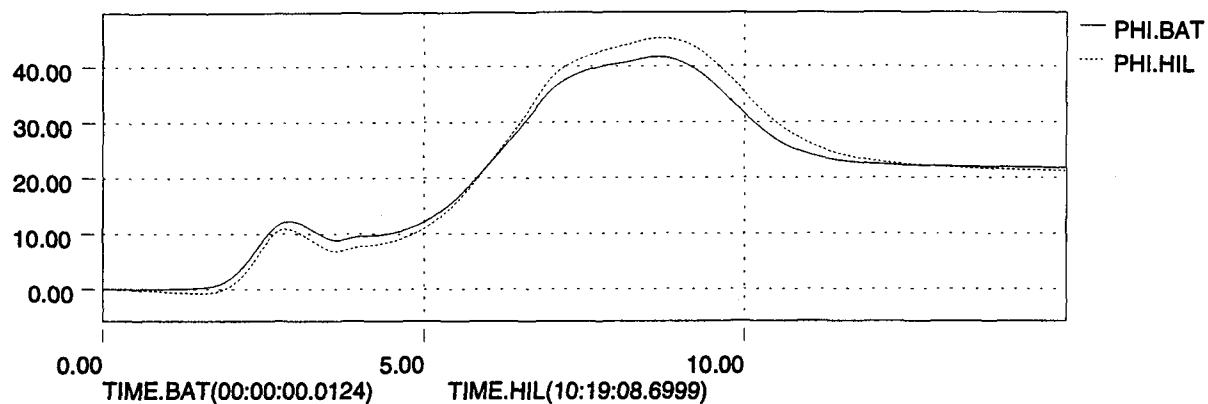
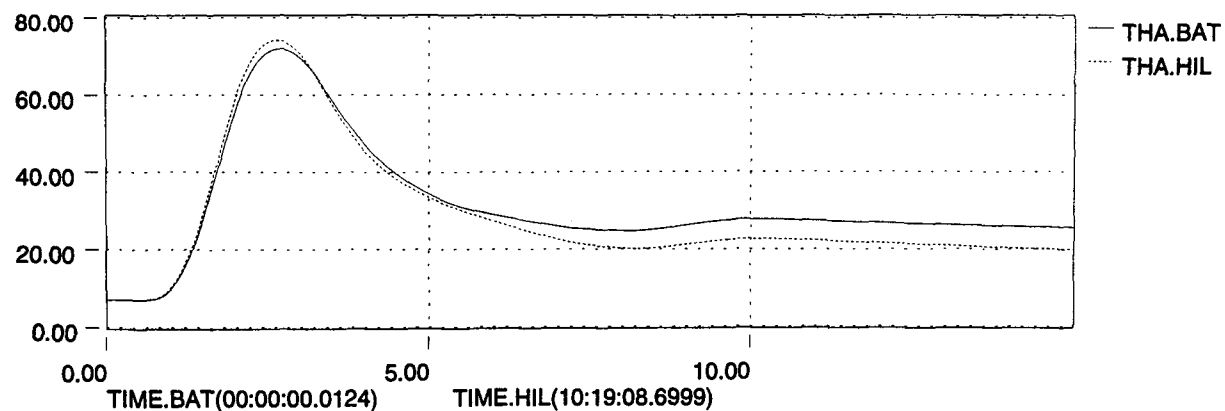


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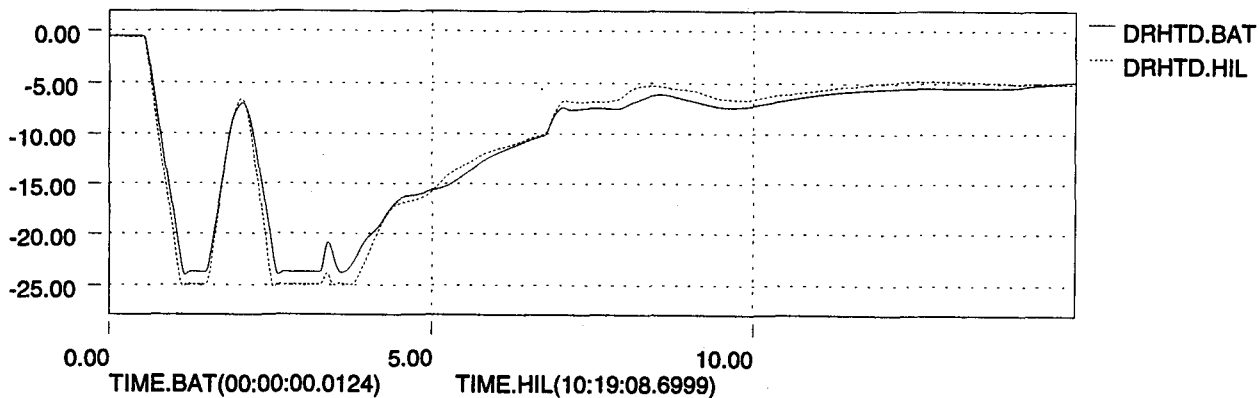
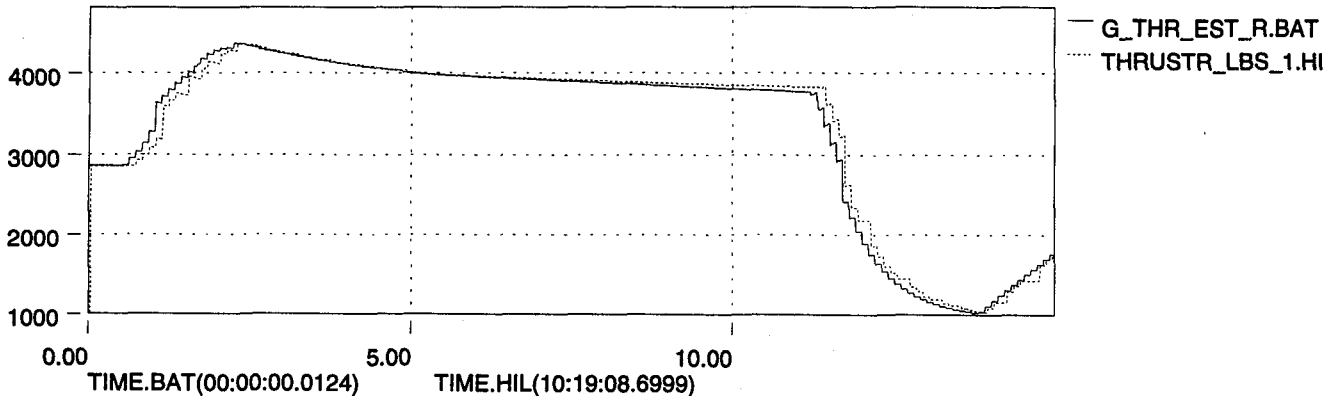
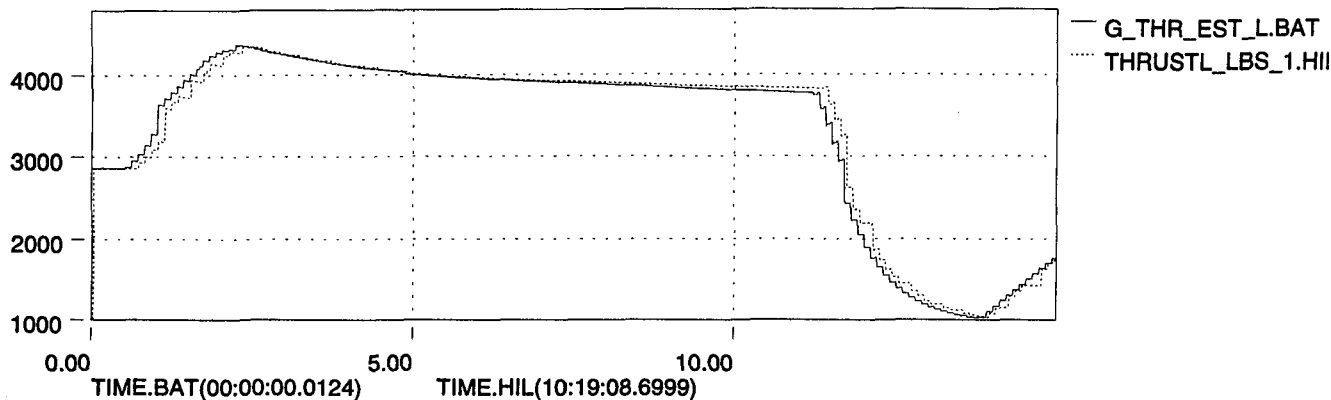
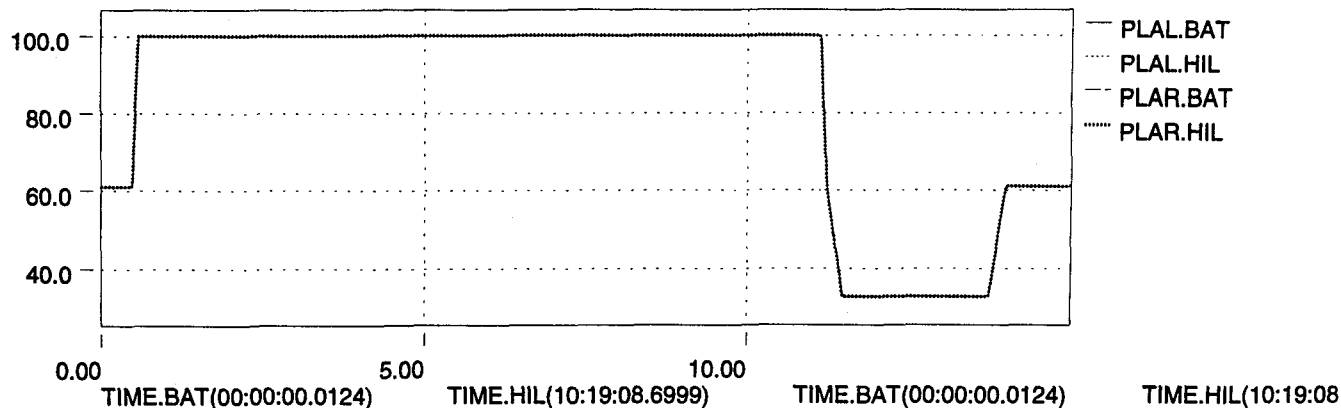
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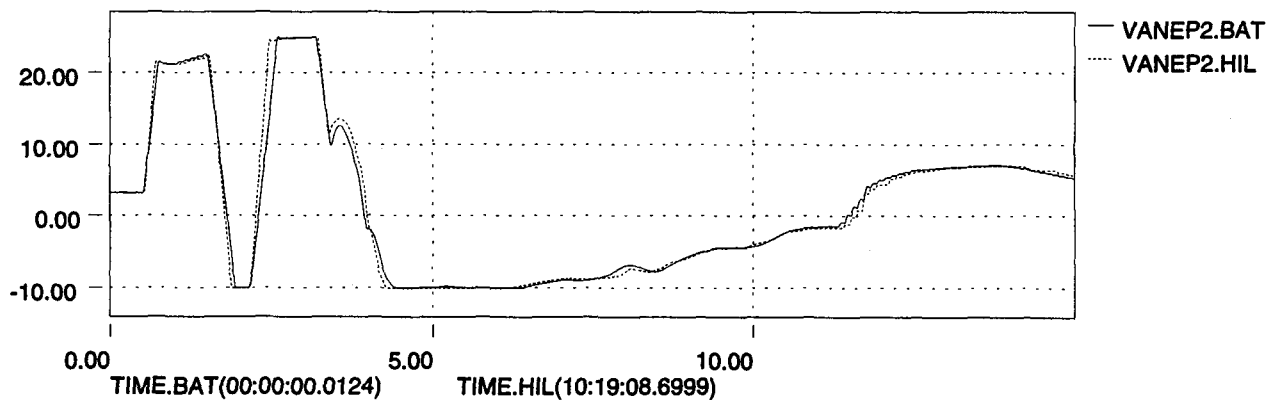
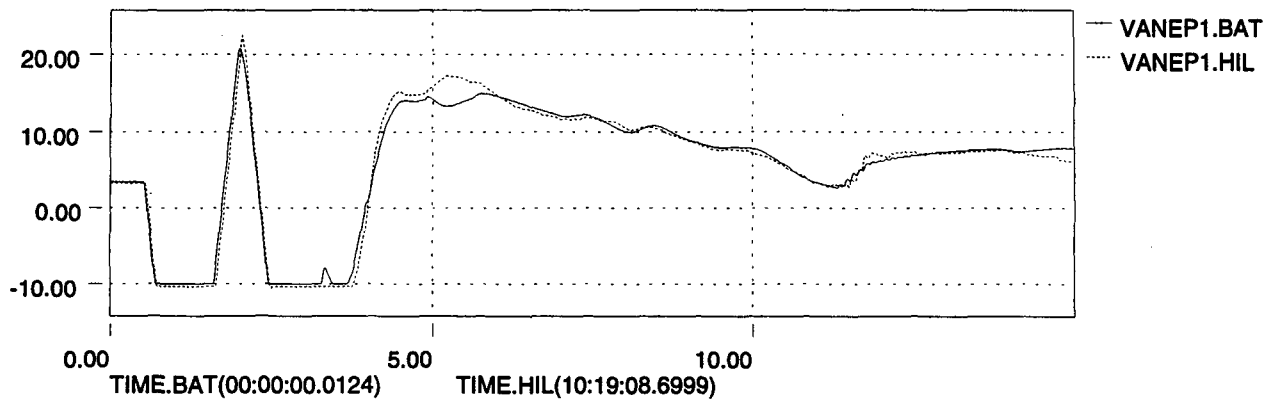
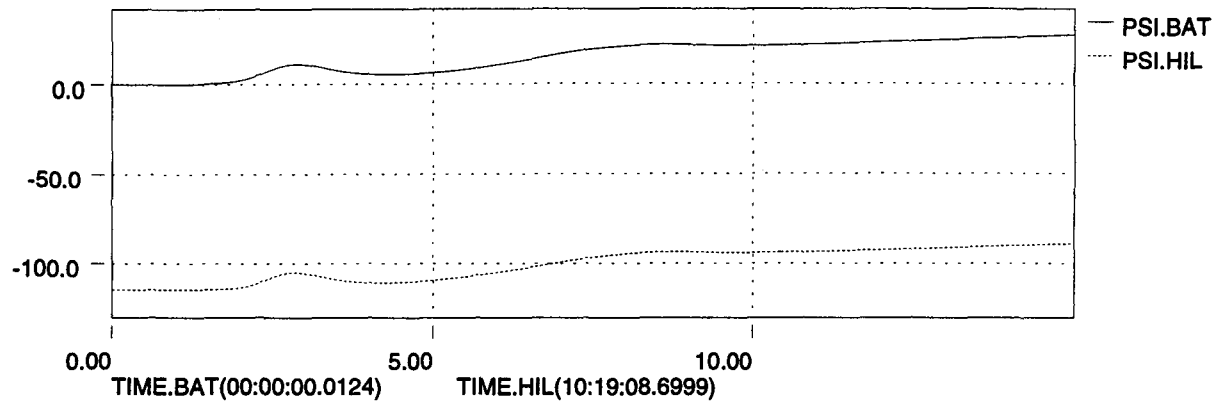
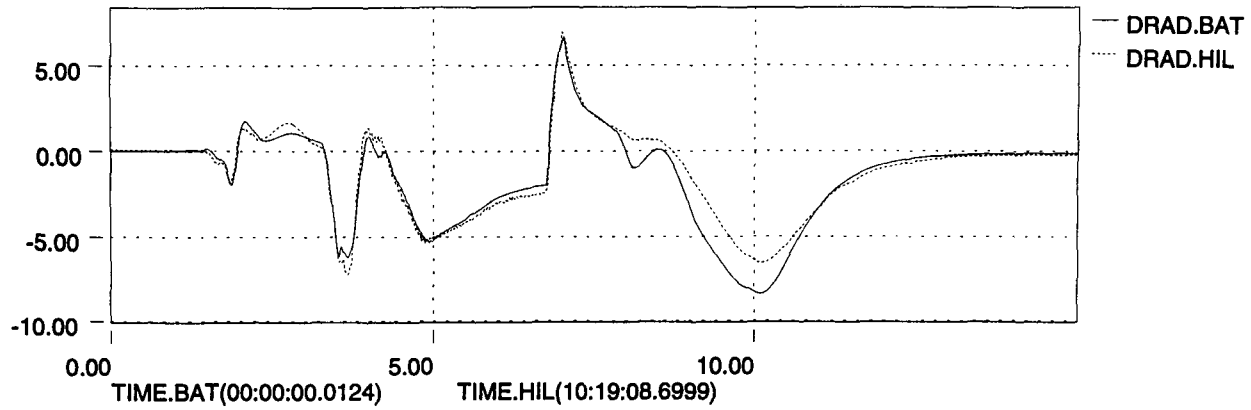


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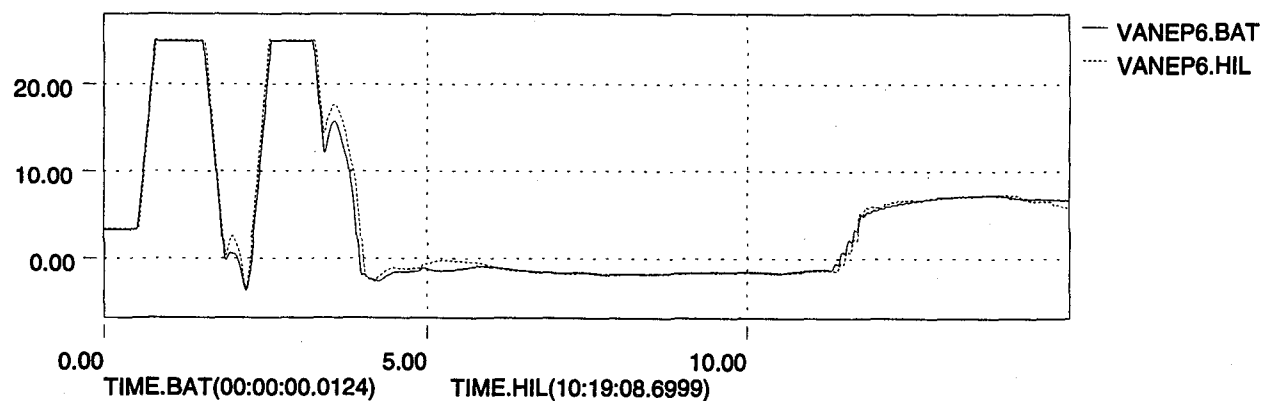
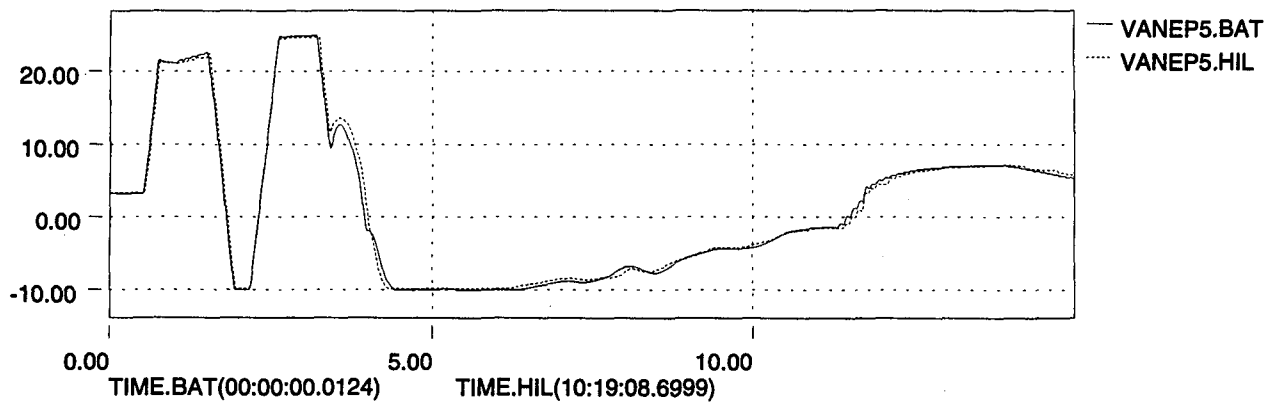
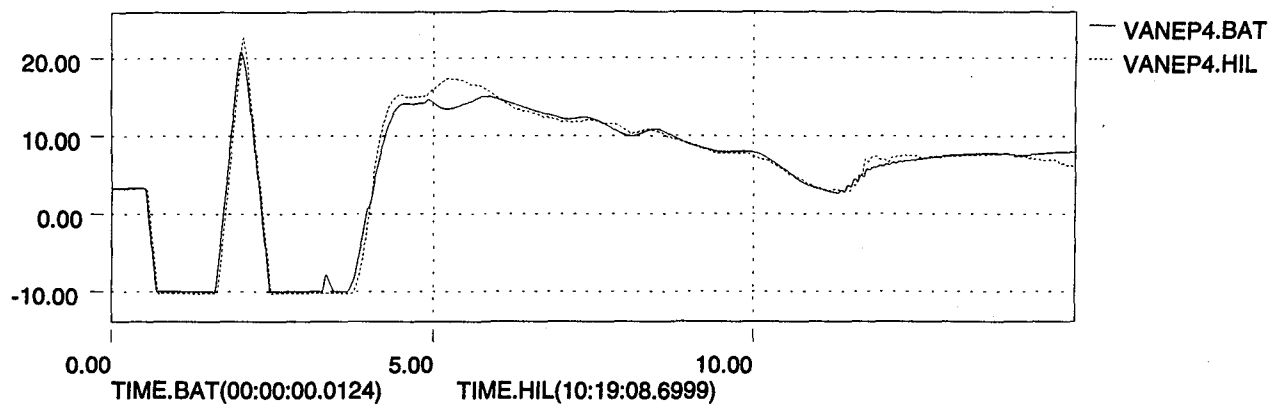
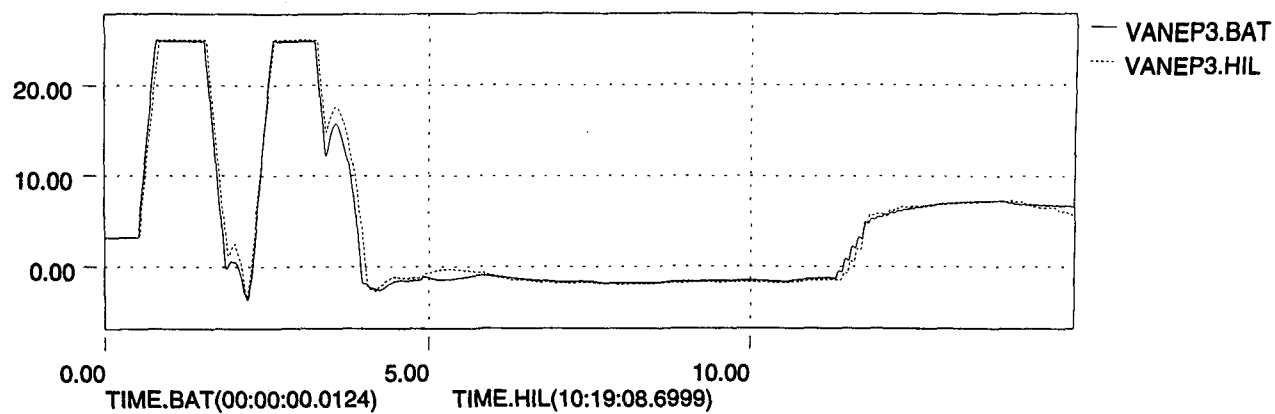
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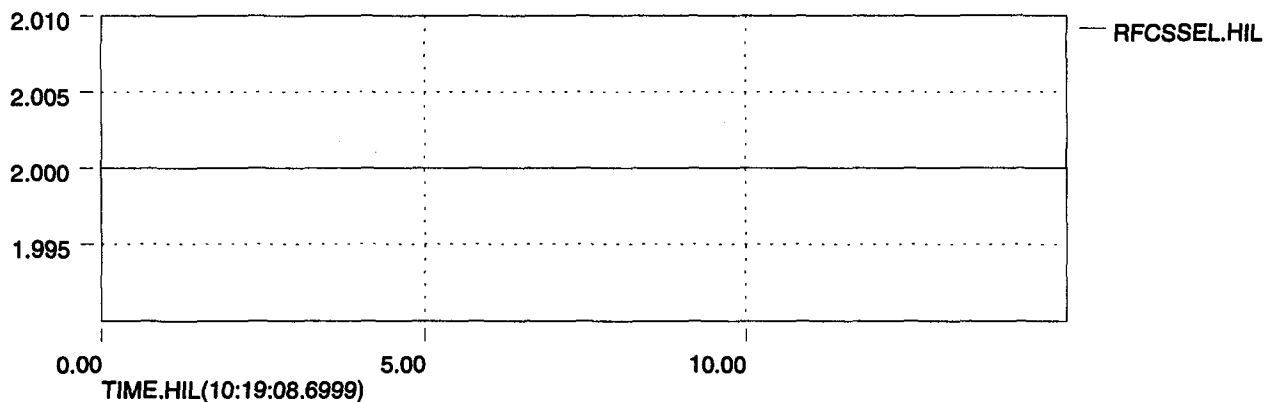
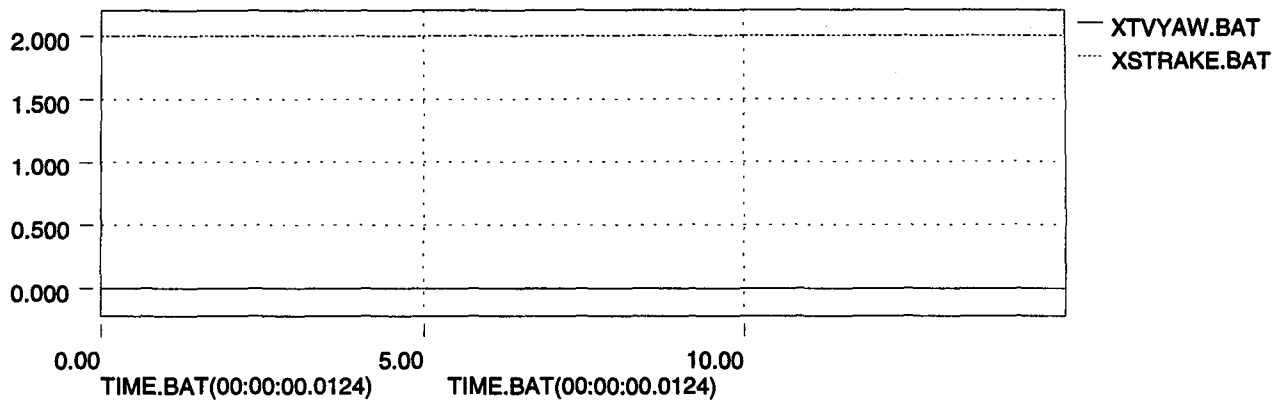
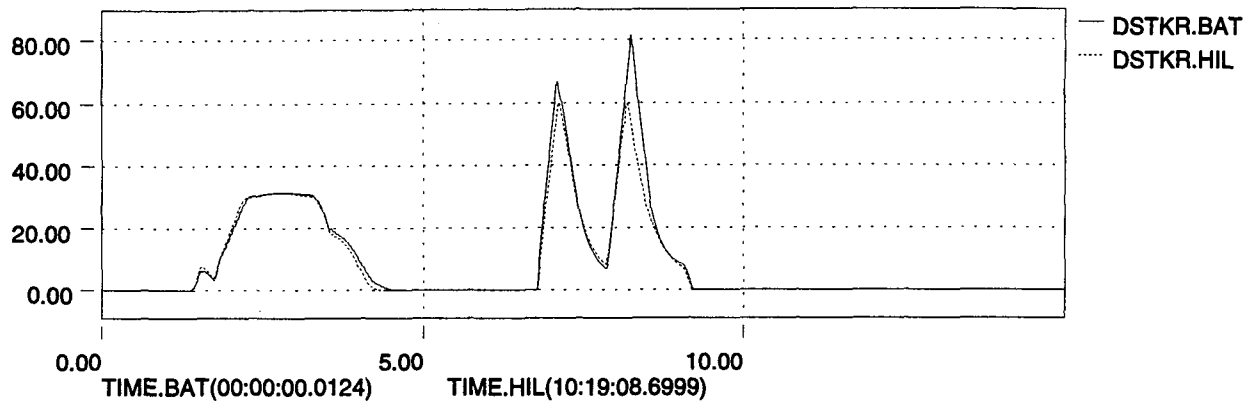
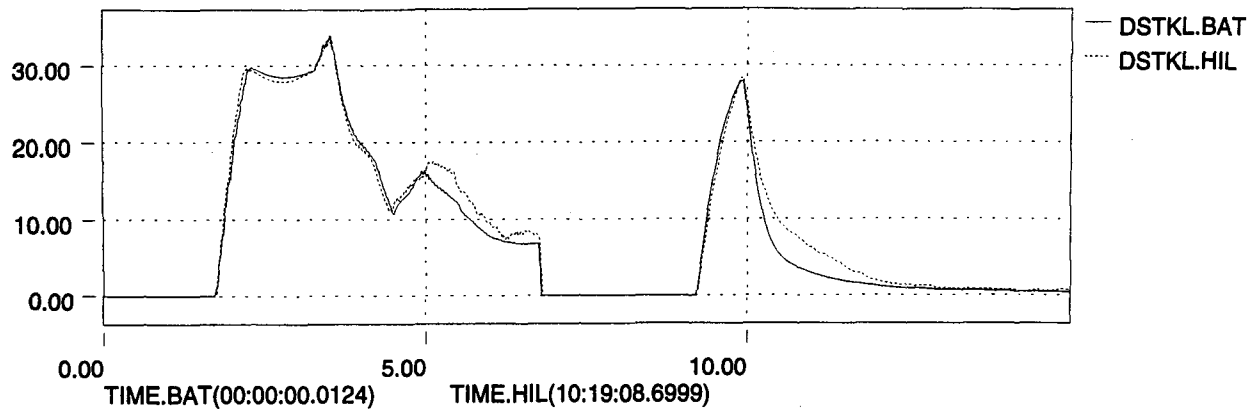


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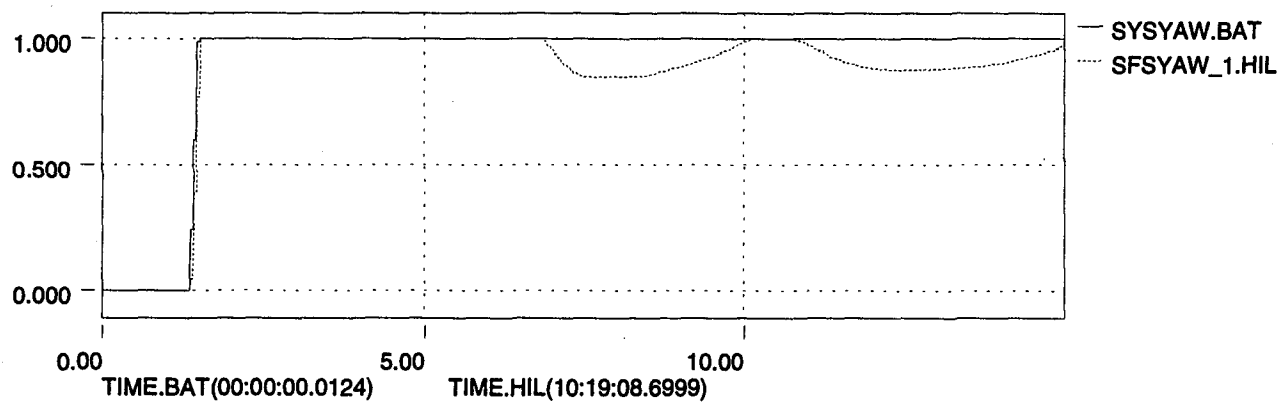
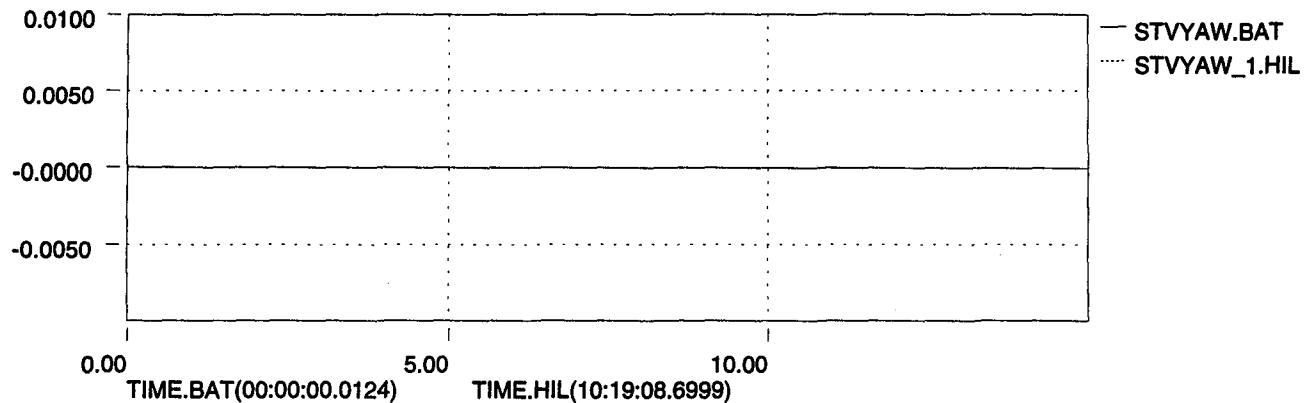
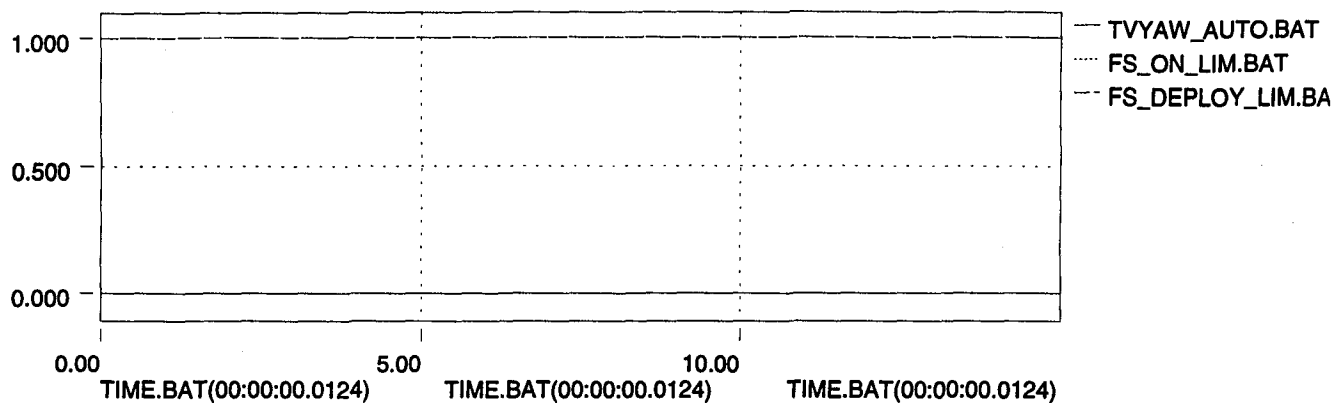
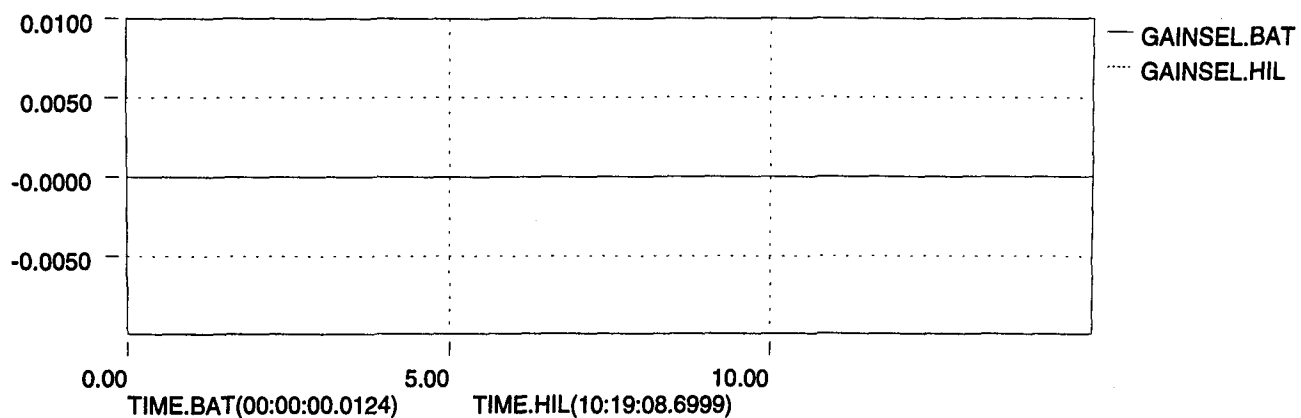
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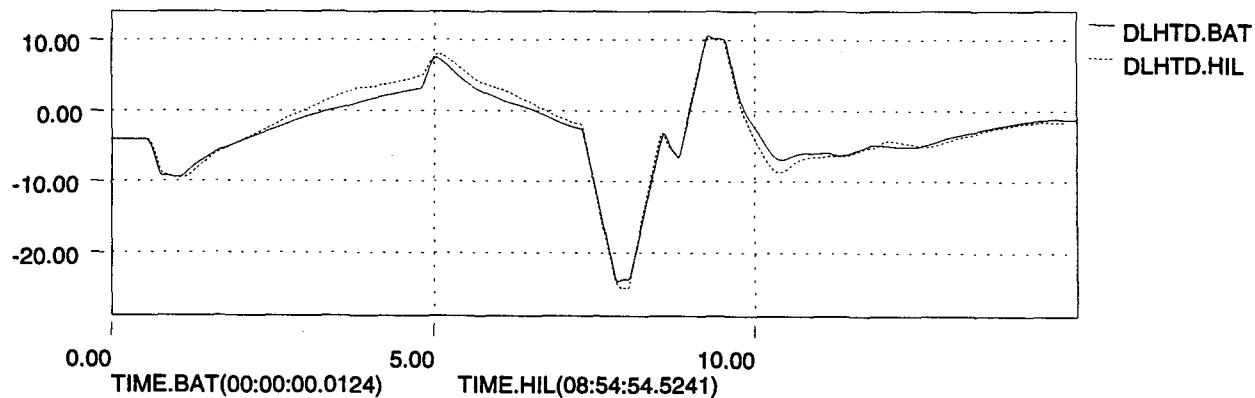
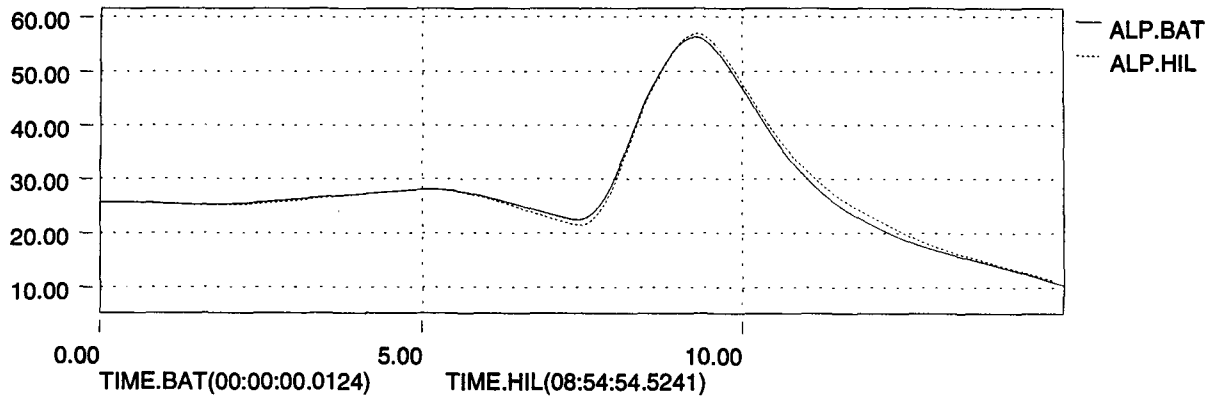
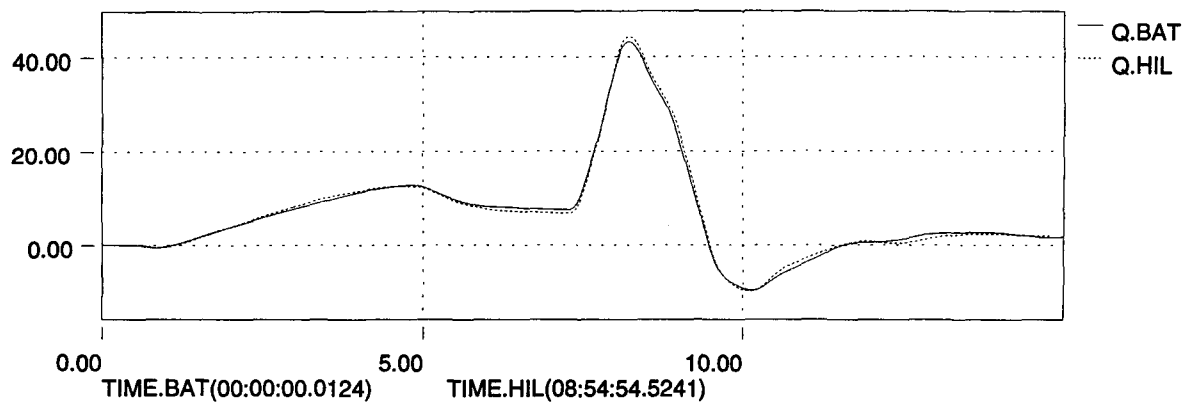
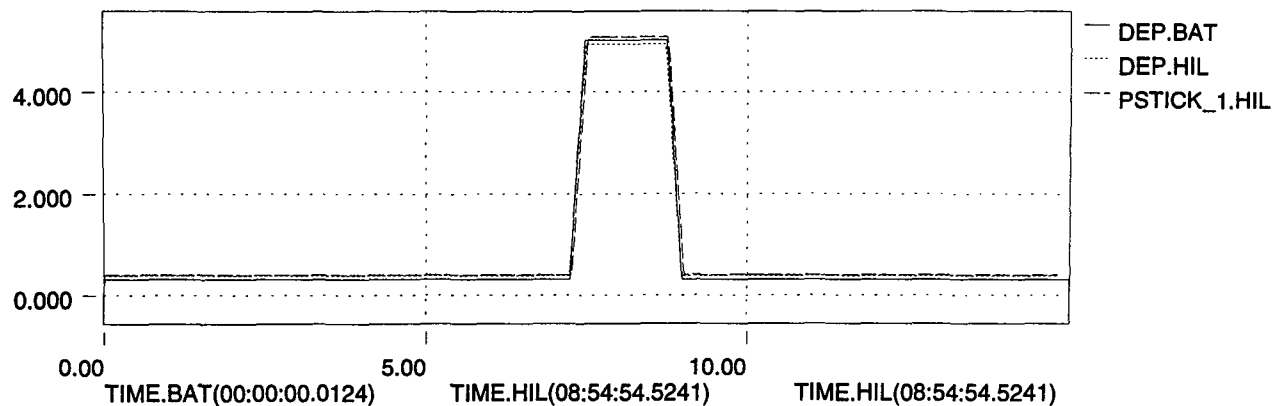
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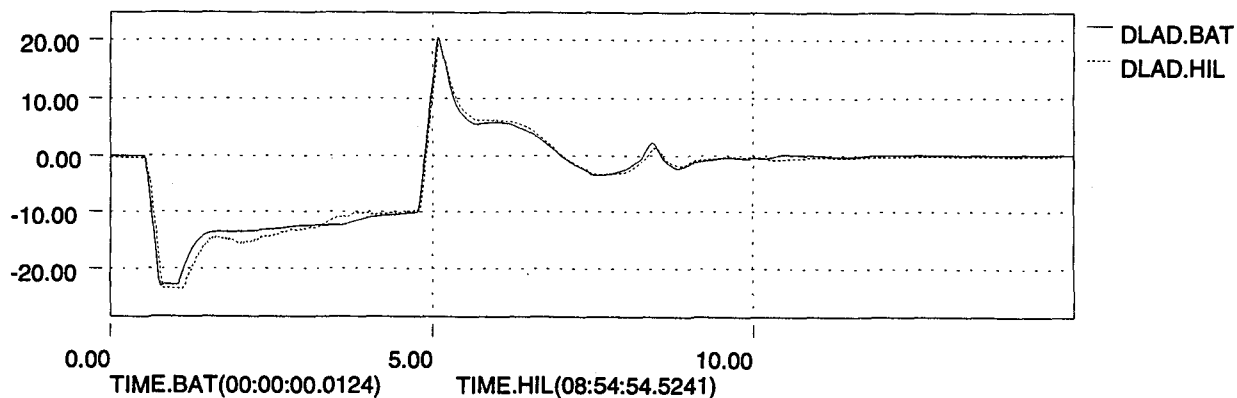
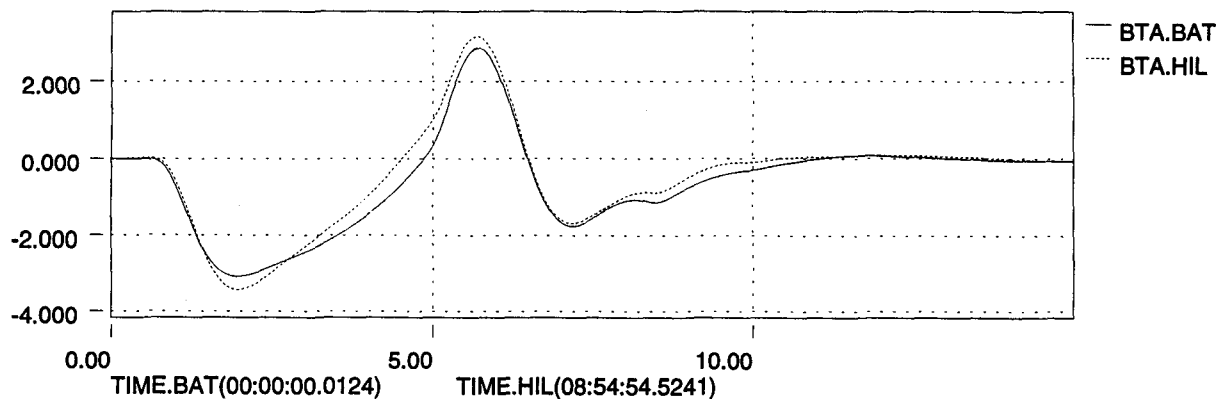
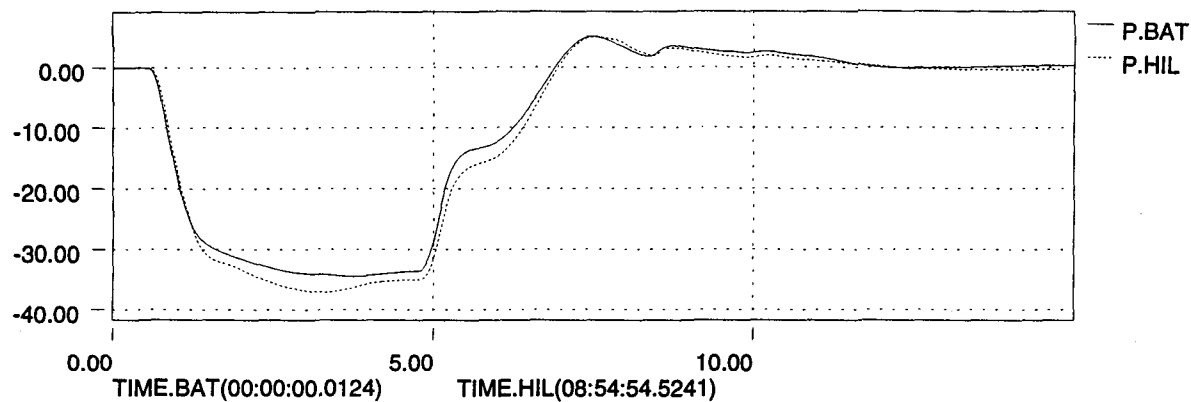
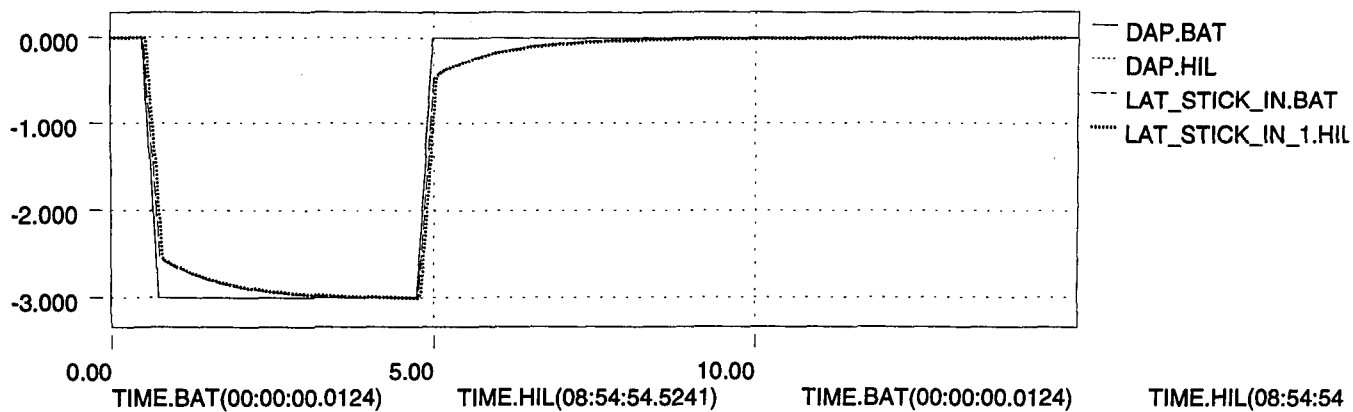
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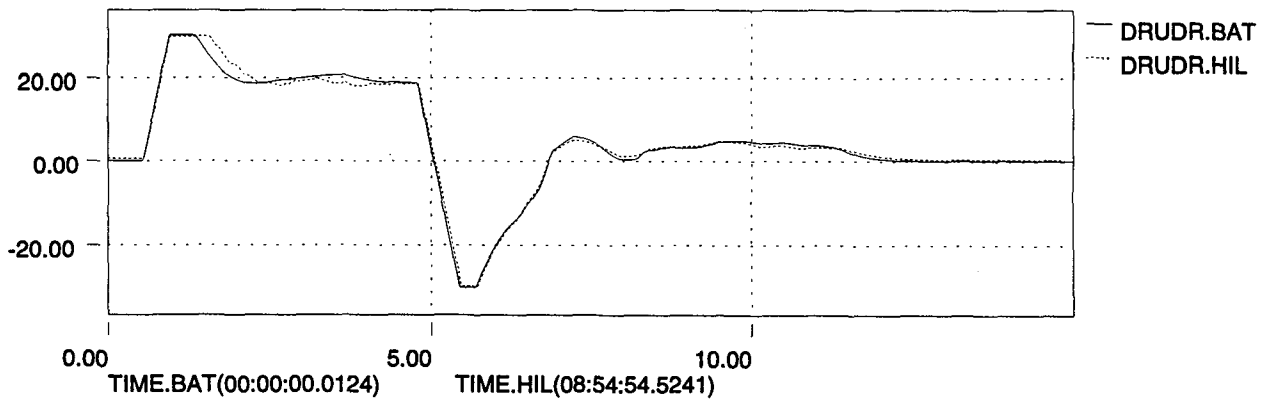
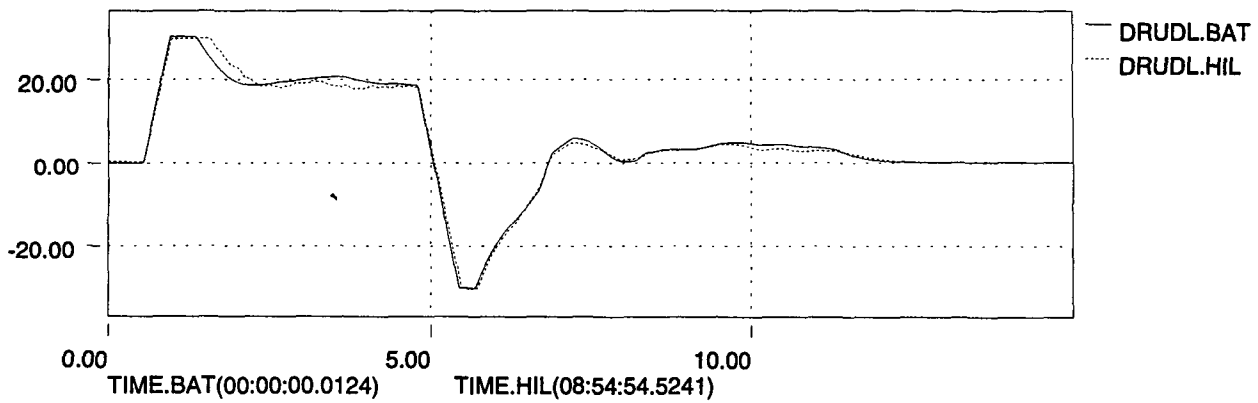
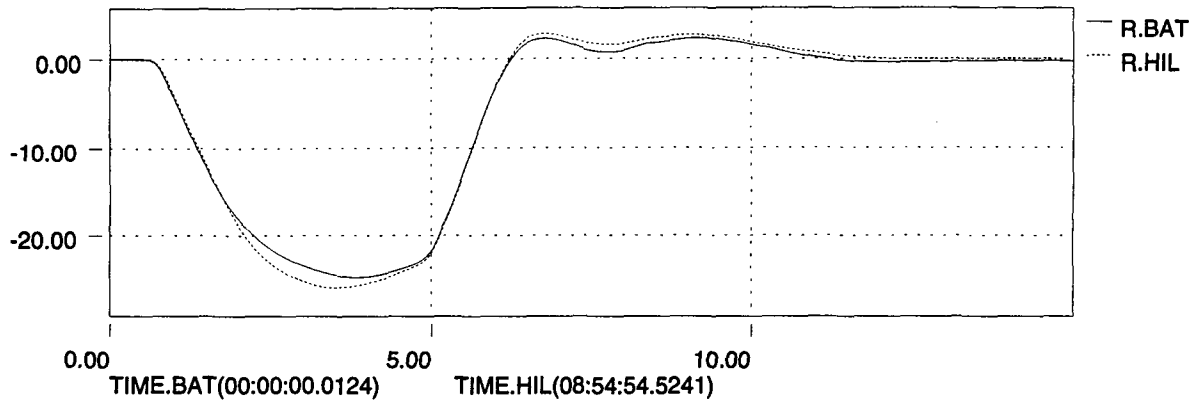
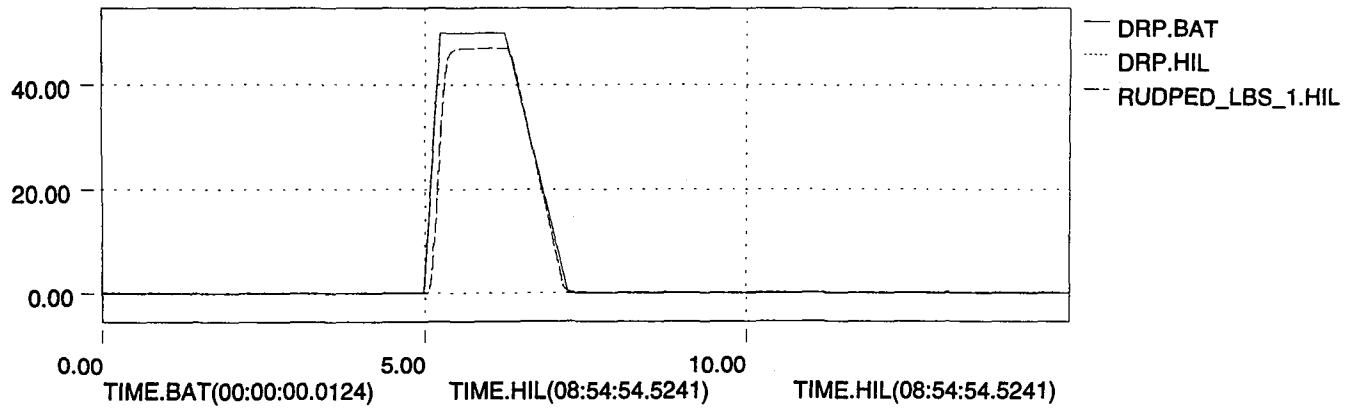


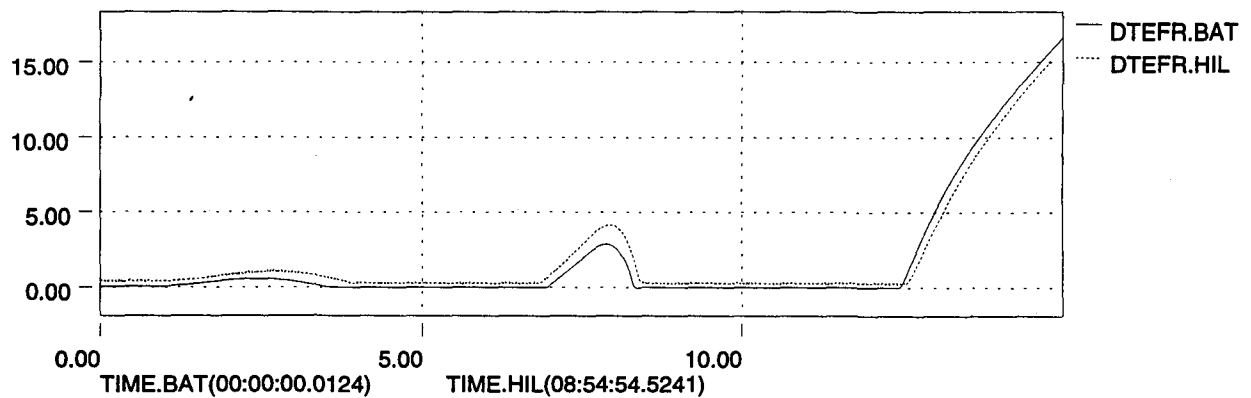
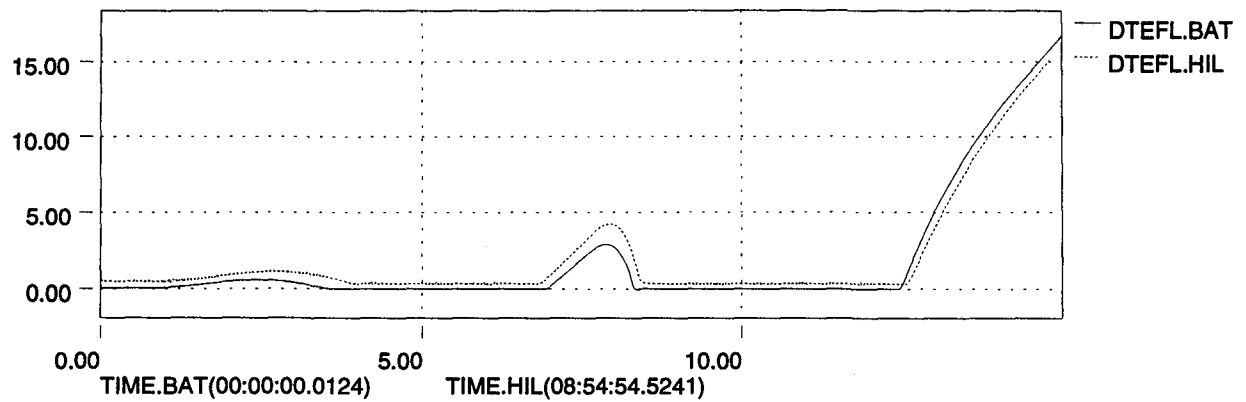
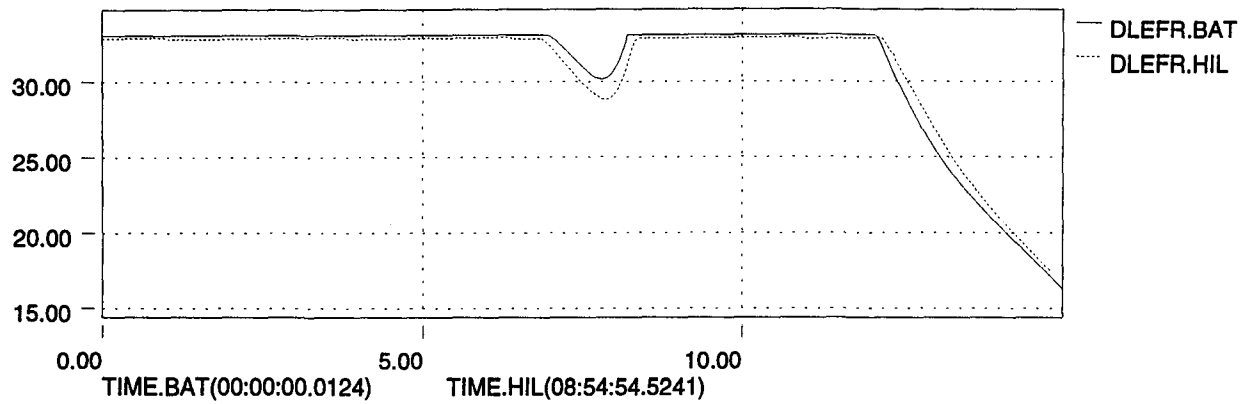
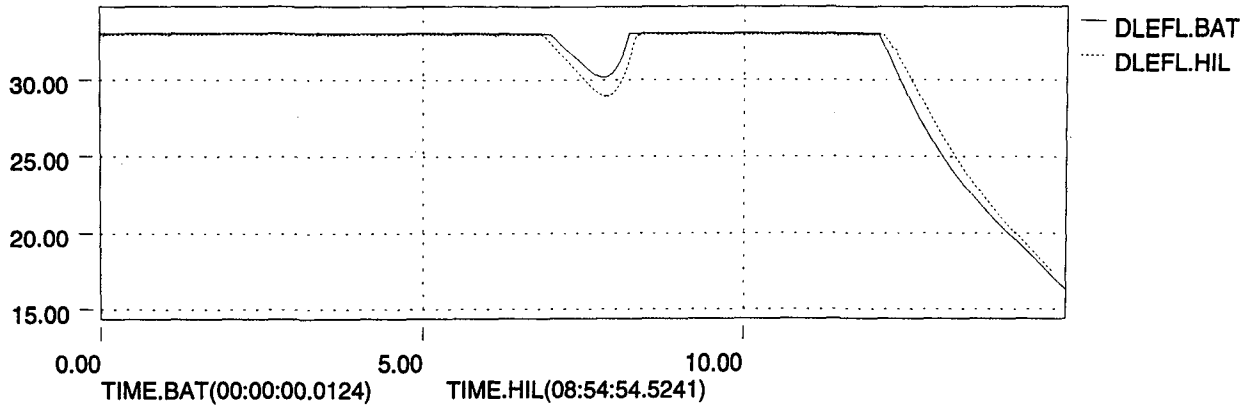


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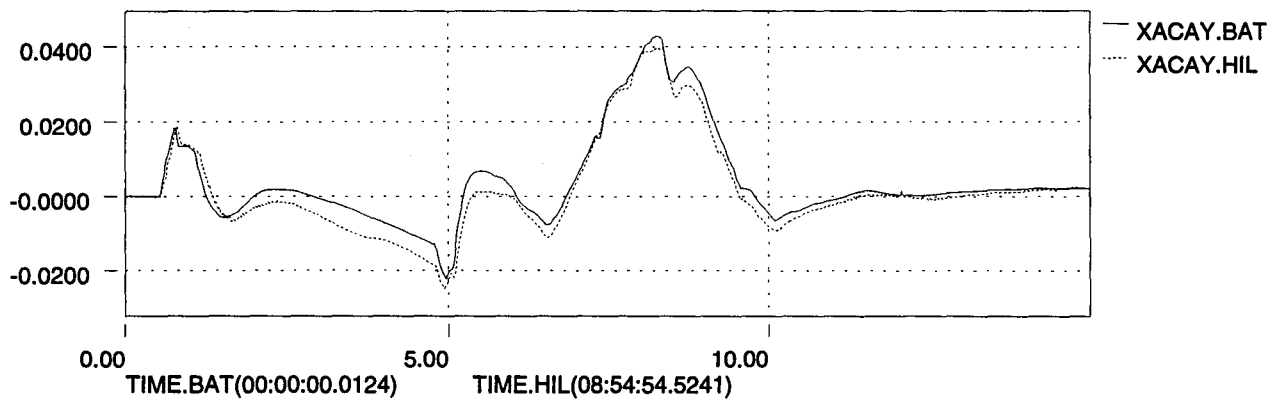
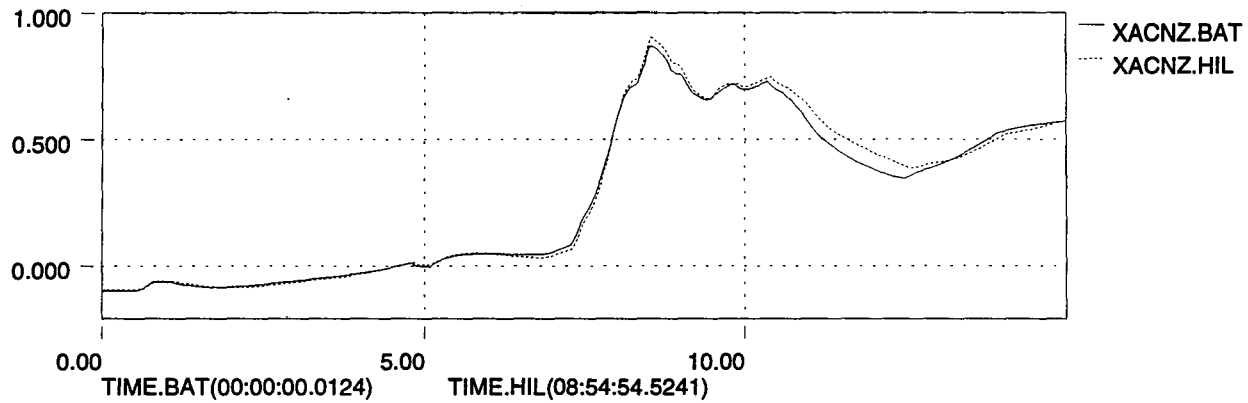
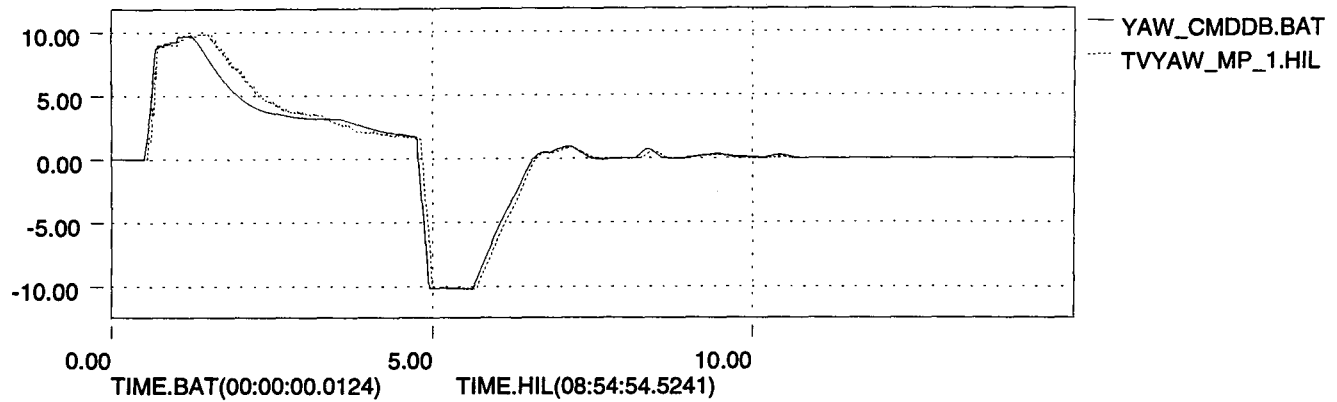
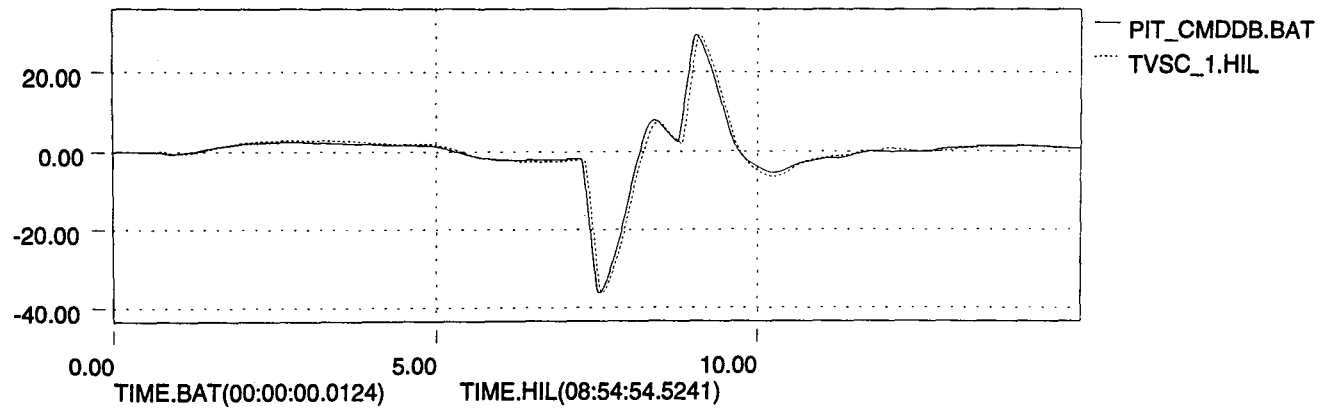


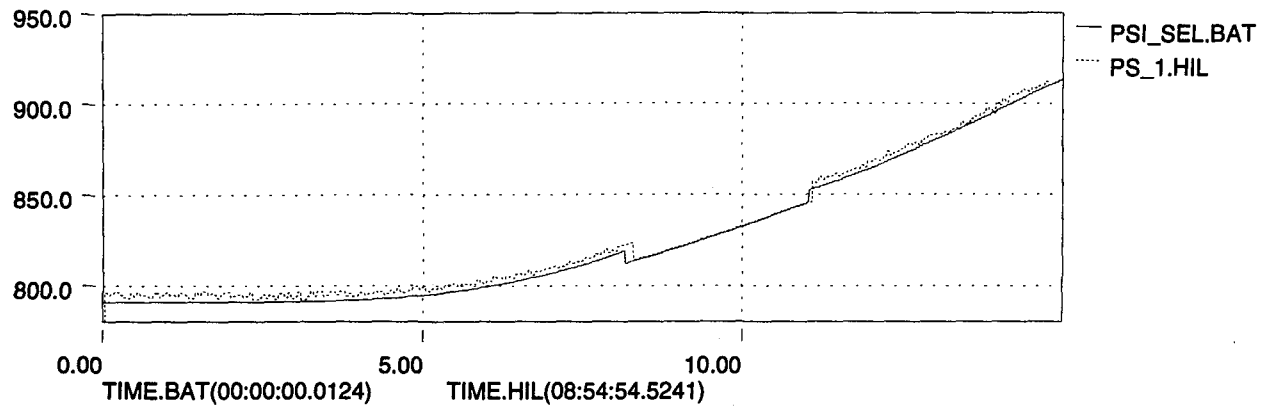
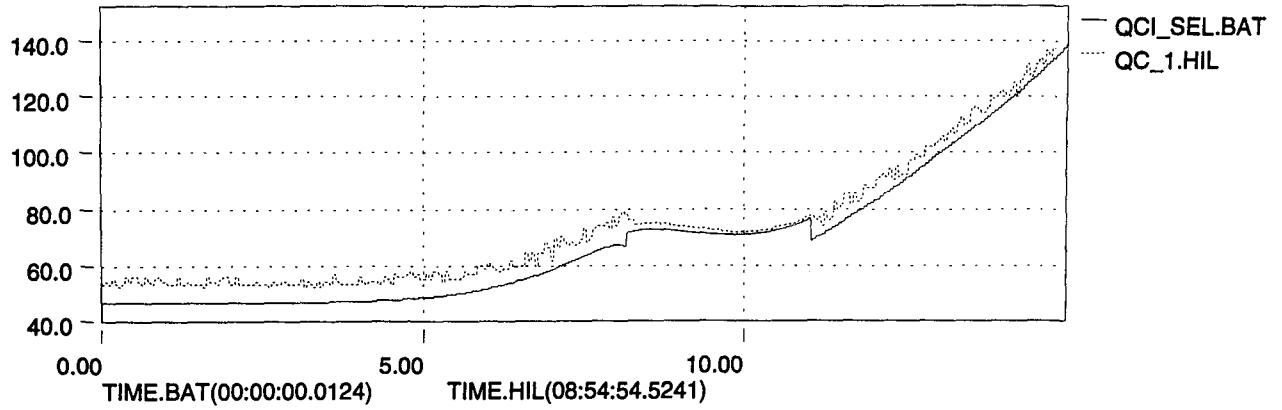




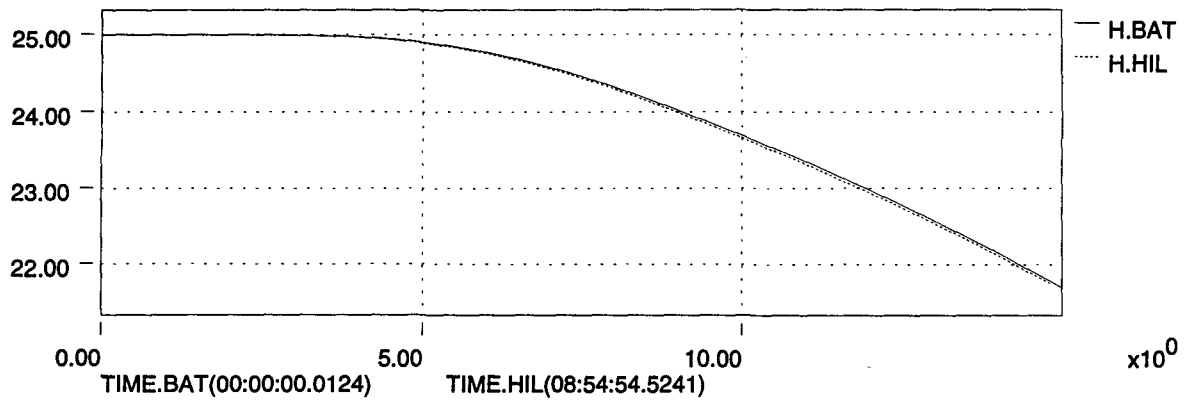
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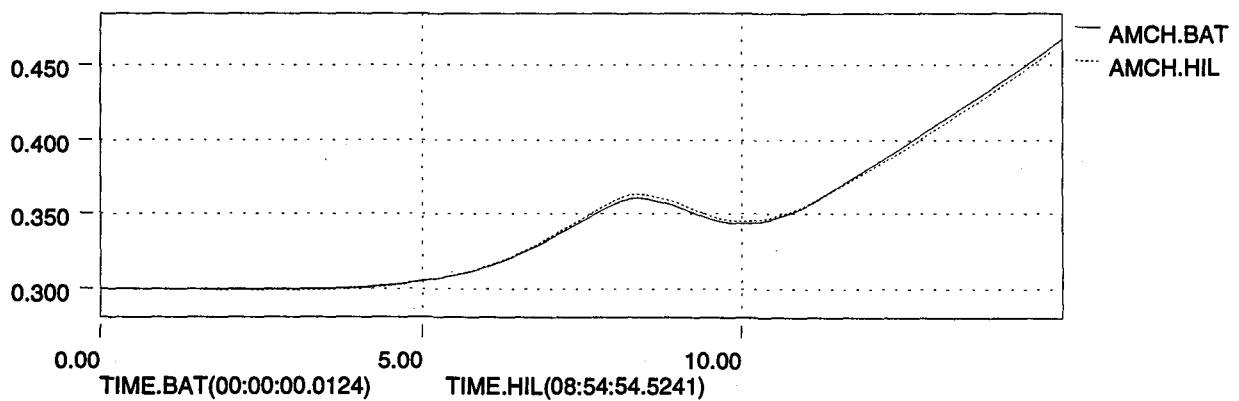




$\times 10^3$

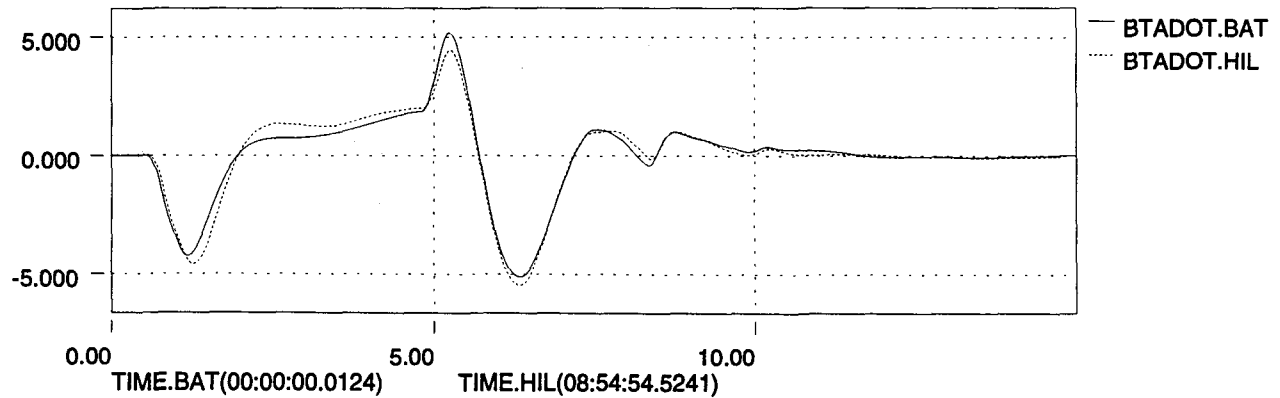
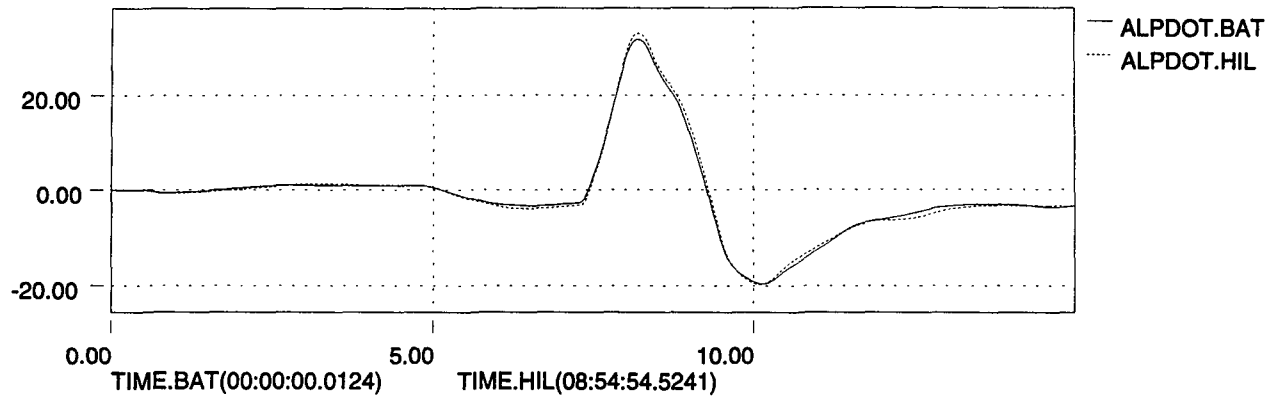
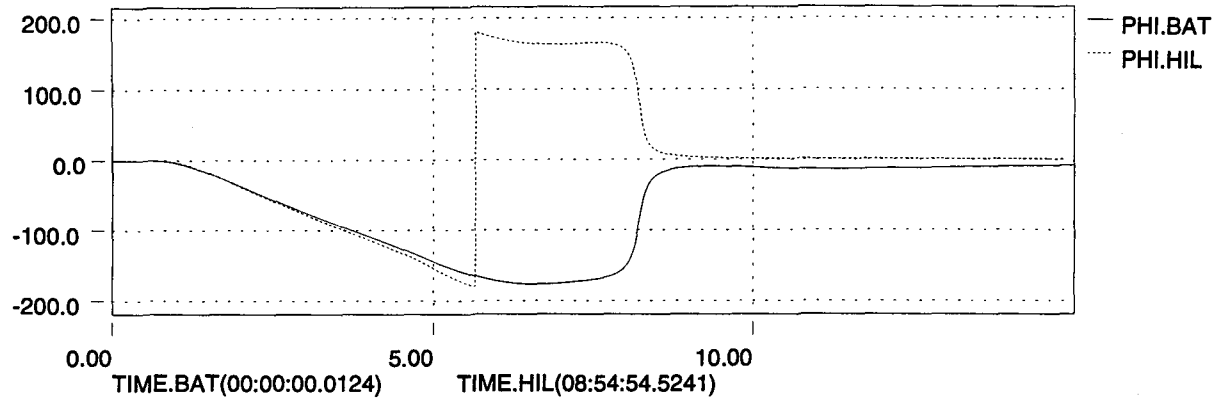
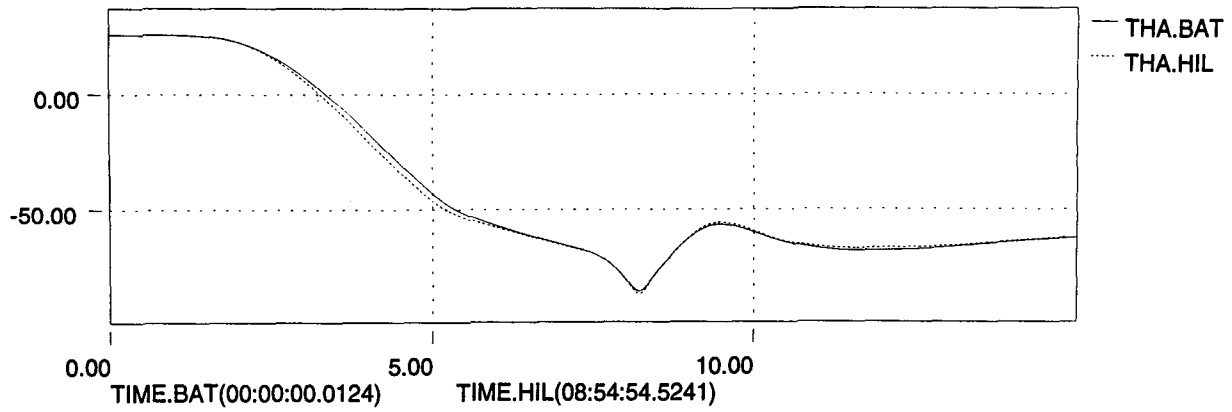


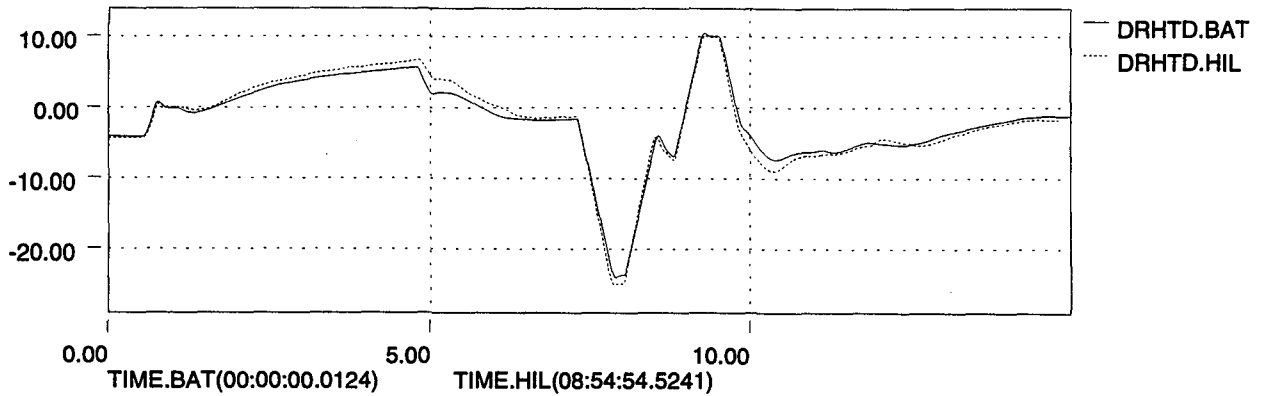
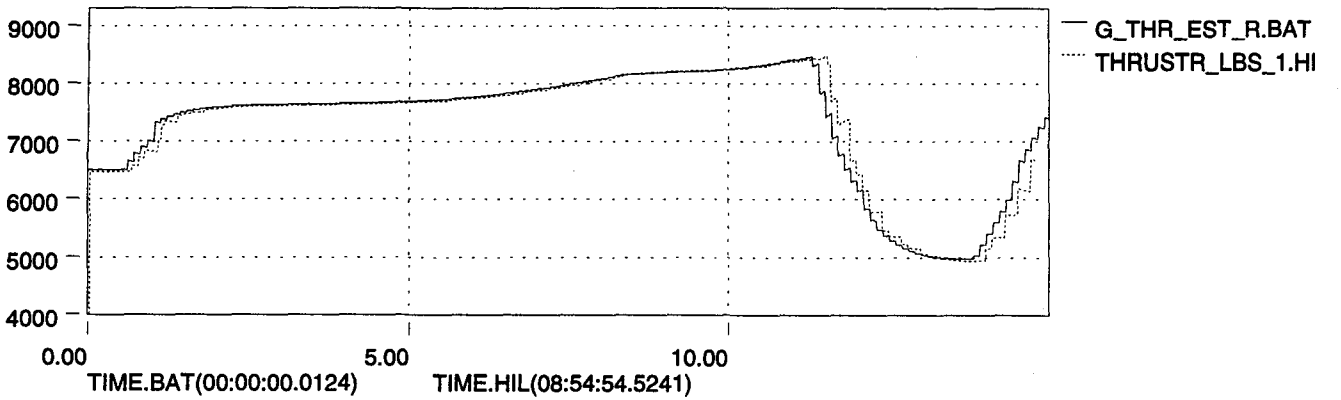
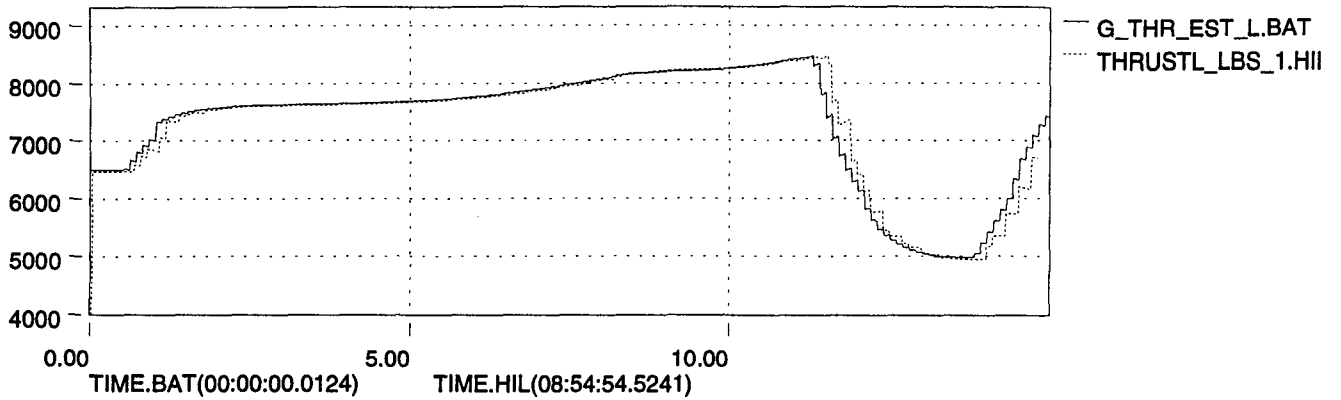
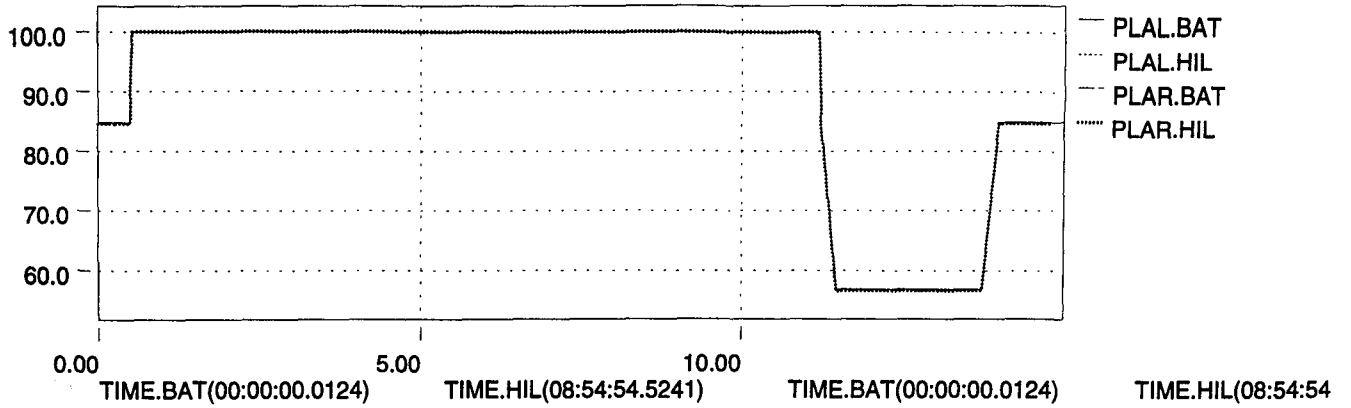
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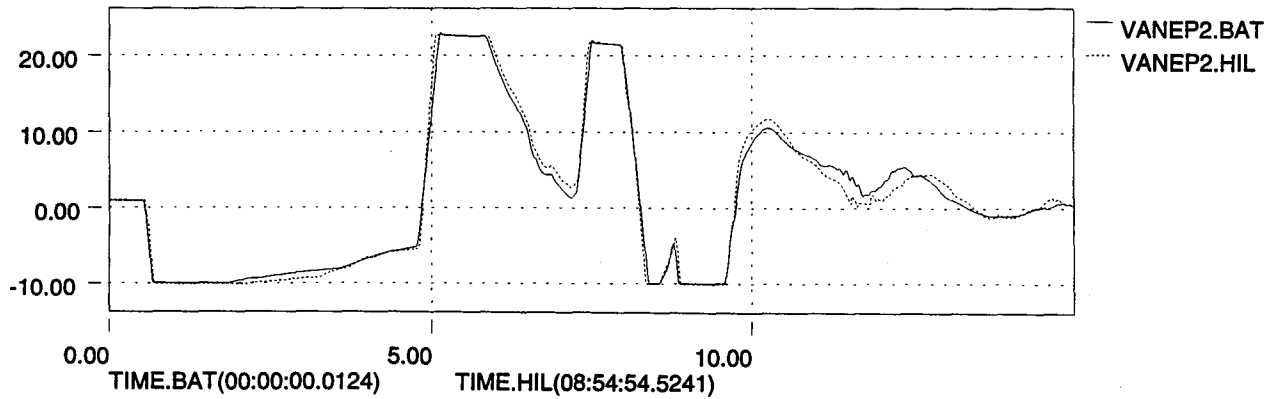
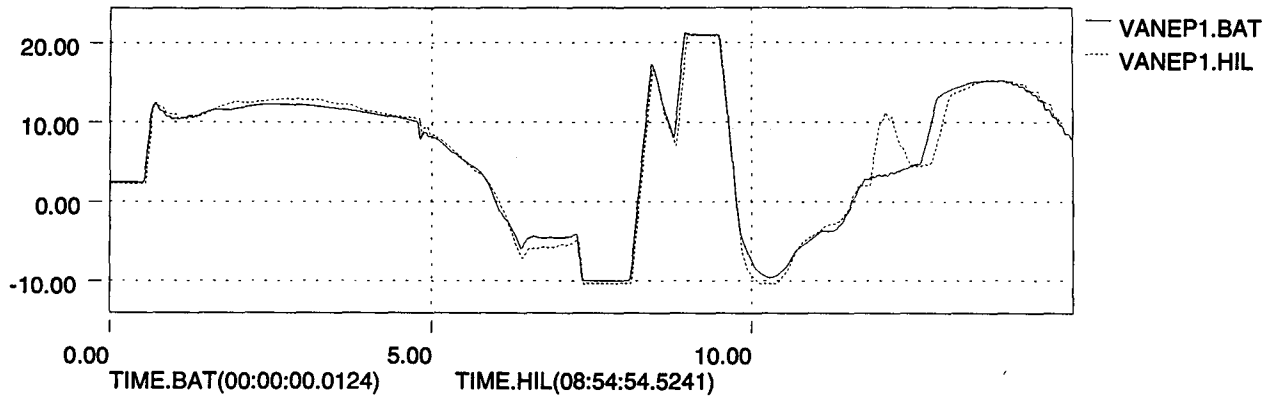
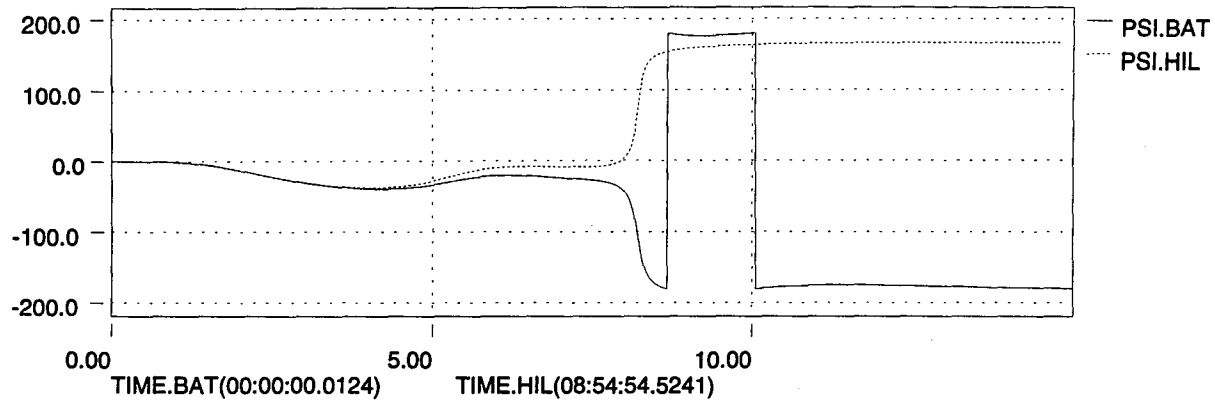
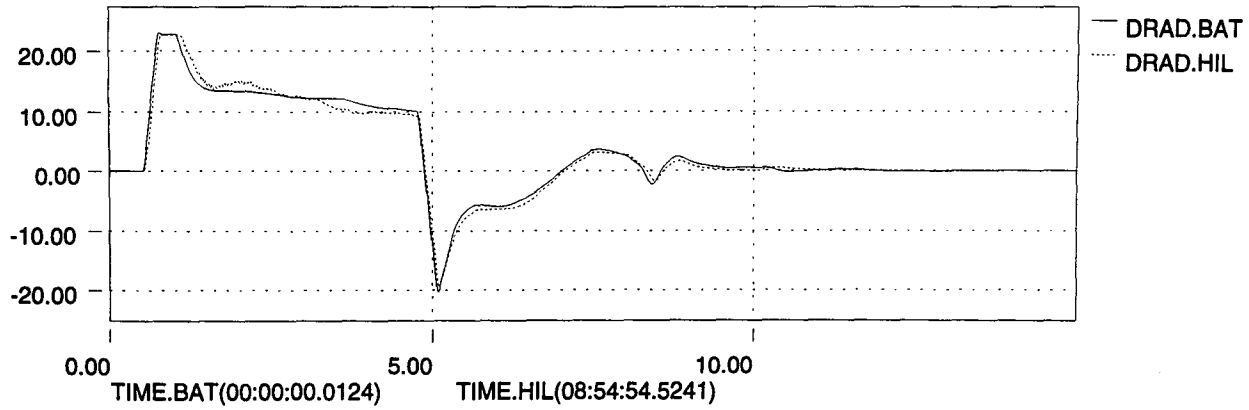
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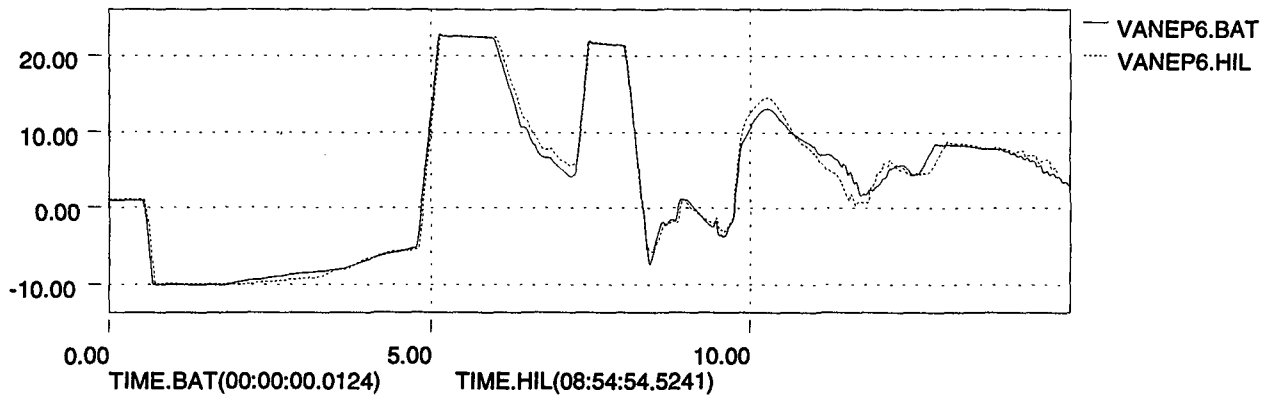
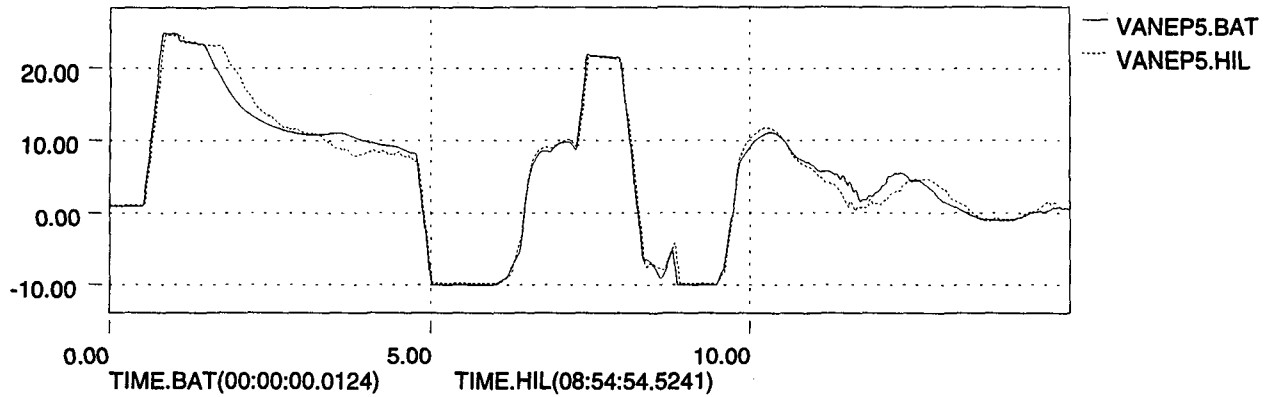
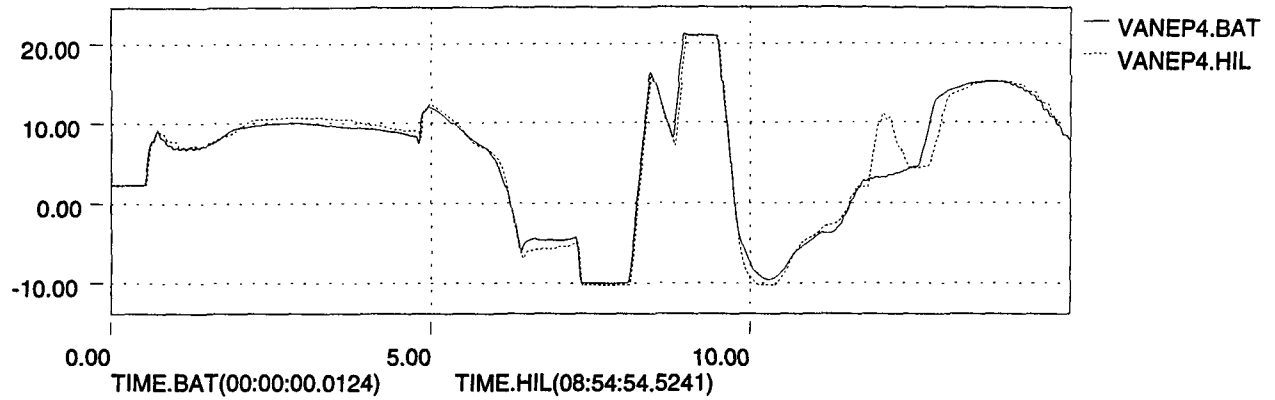
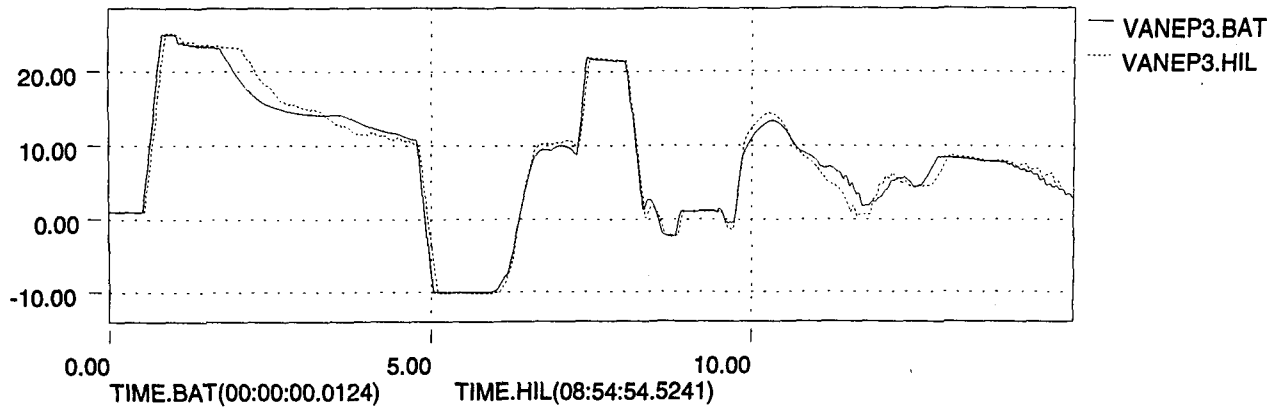




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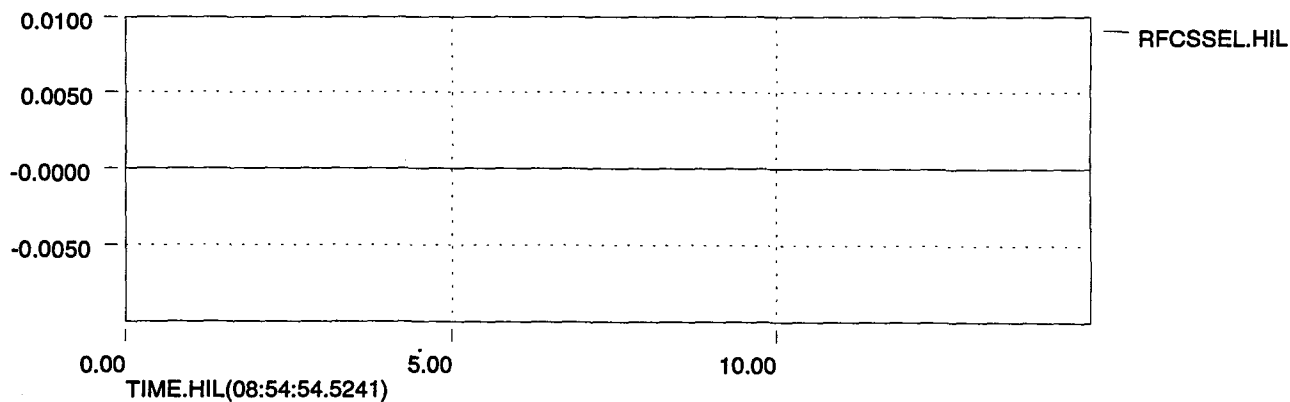
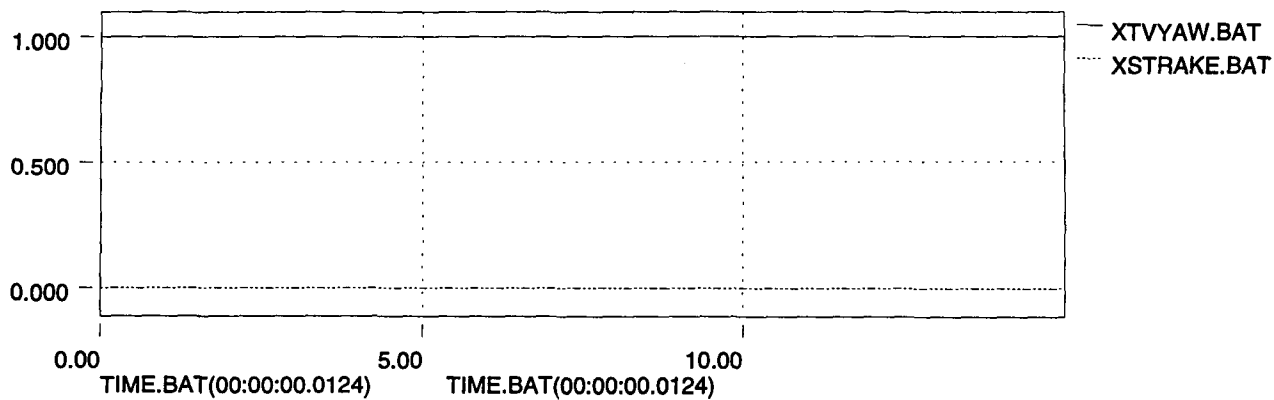
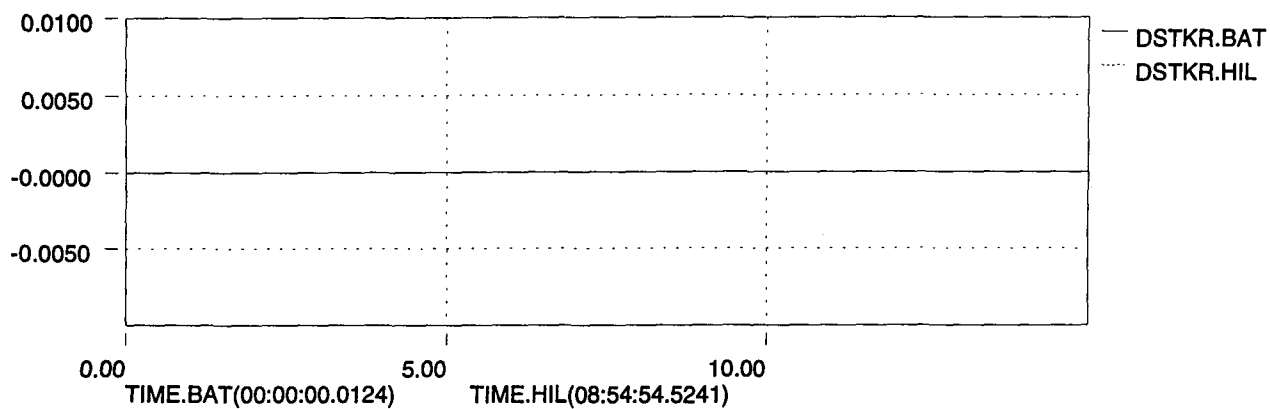
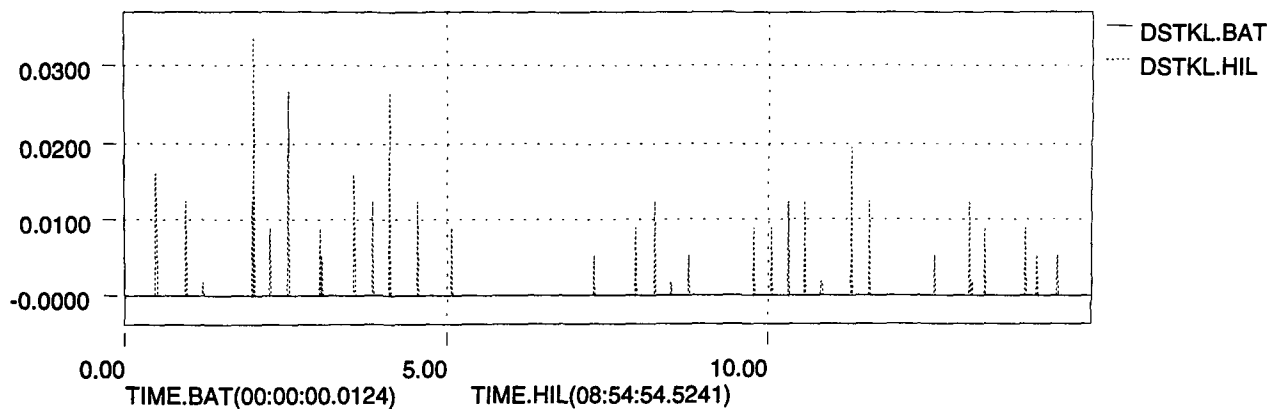
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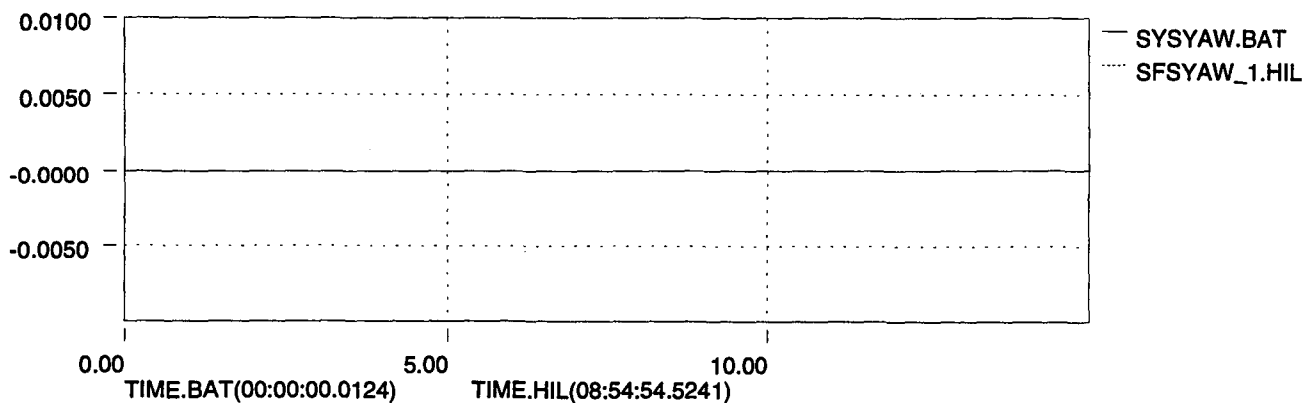
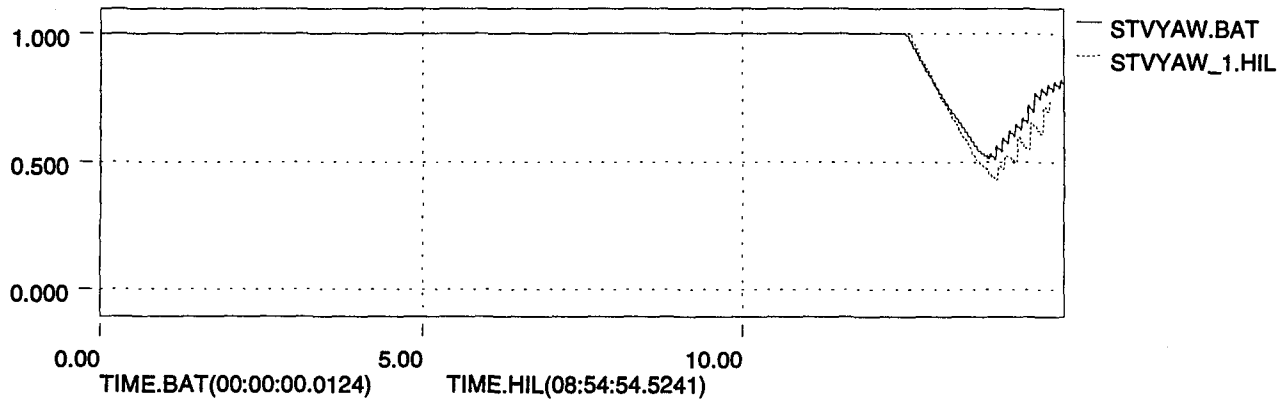
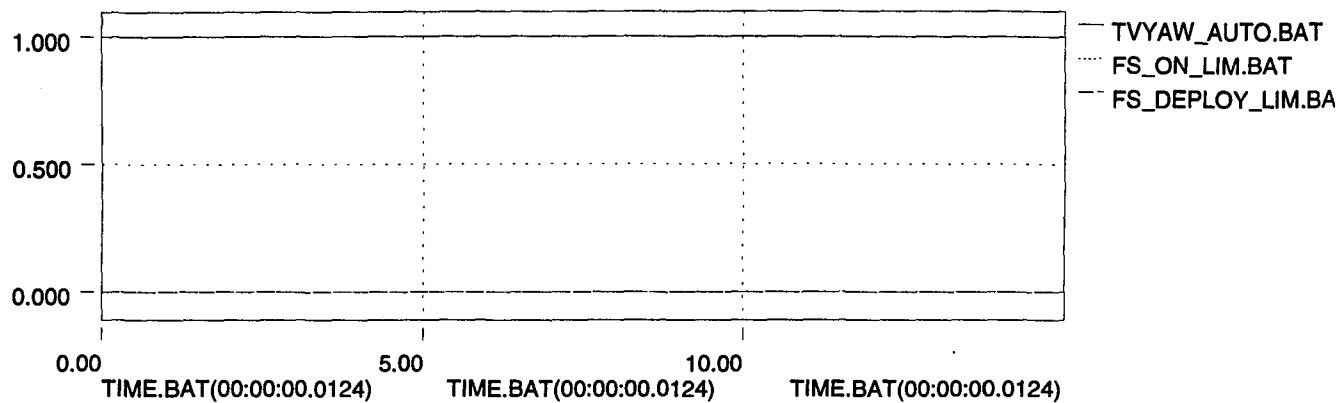
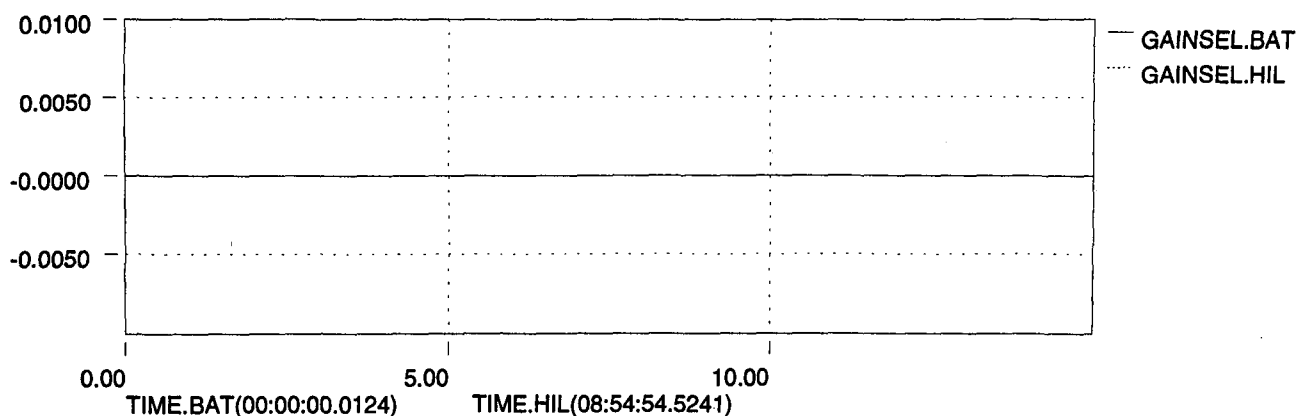
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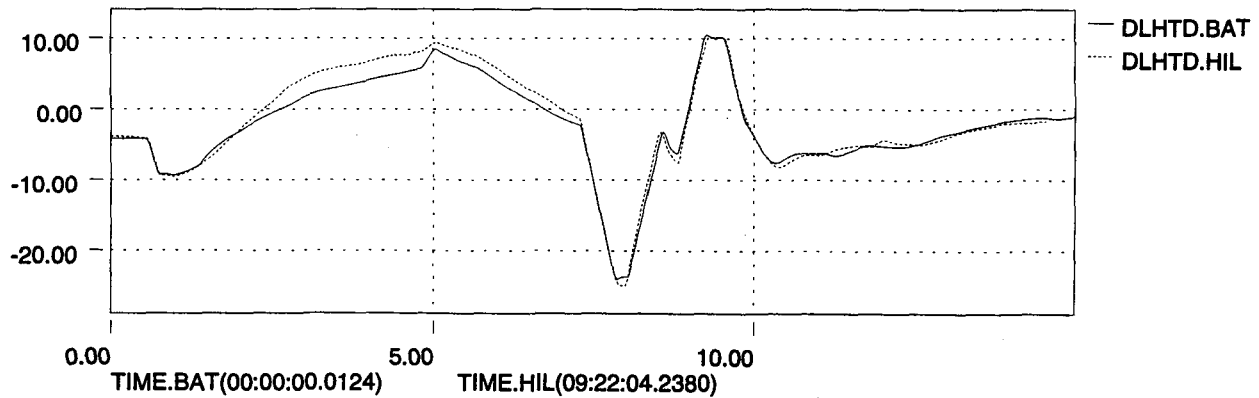
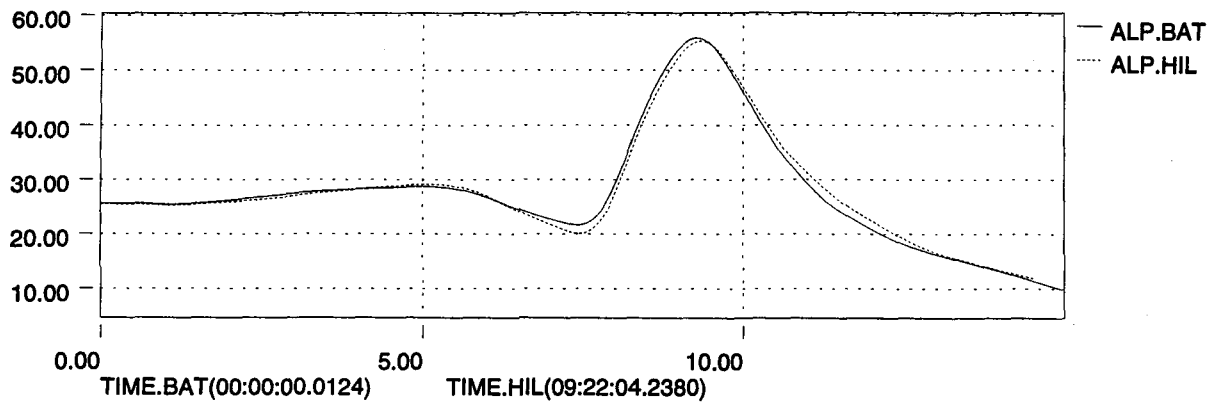
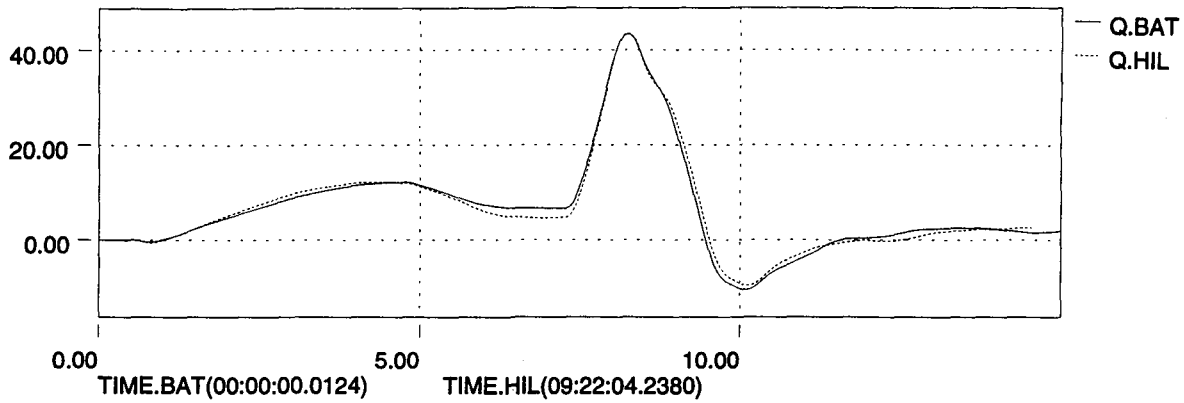
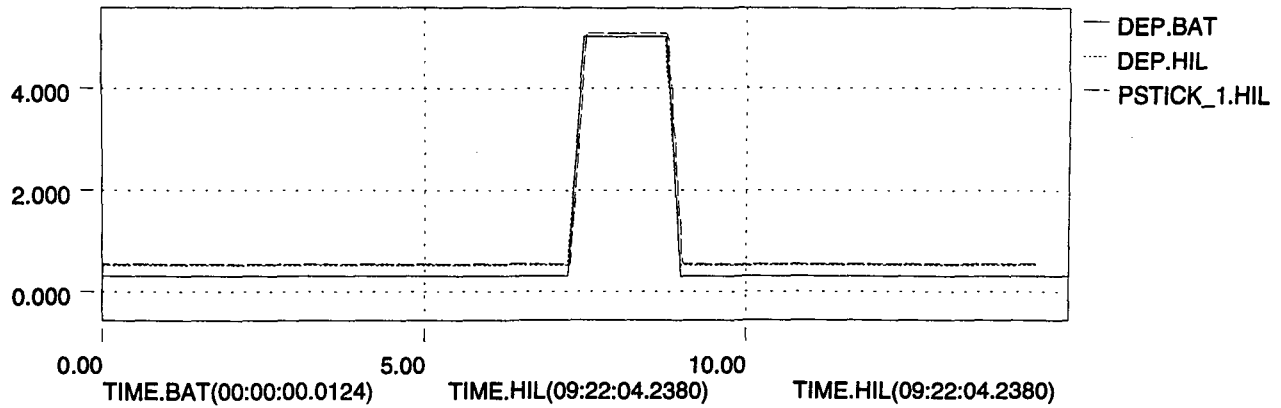
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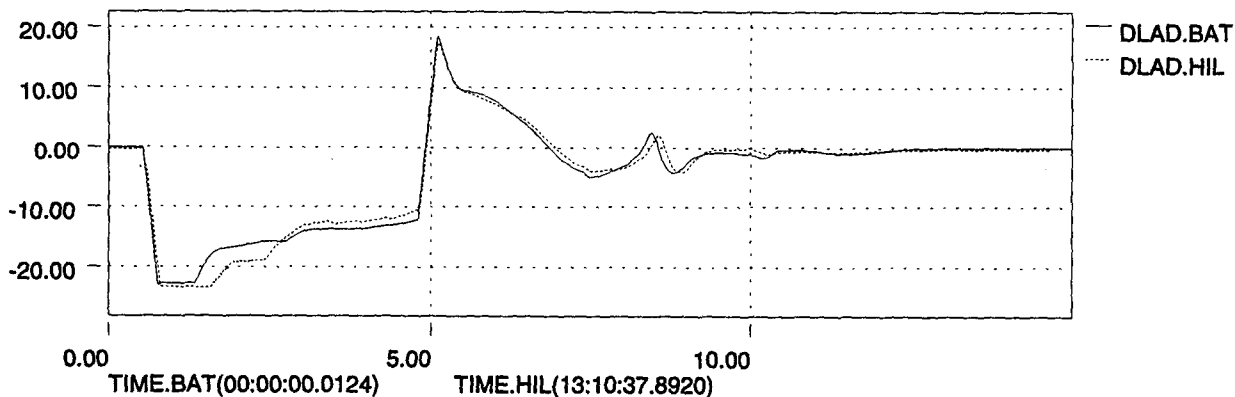
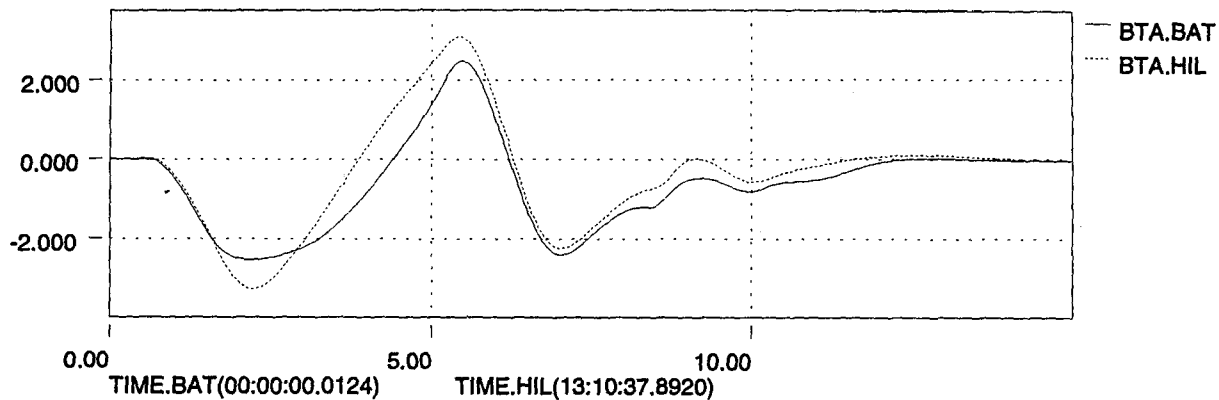
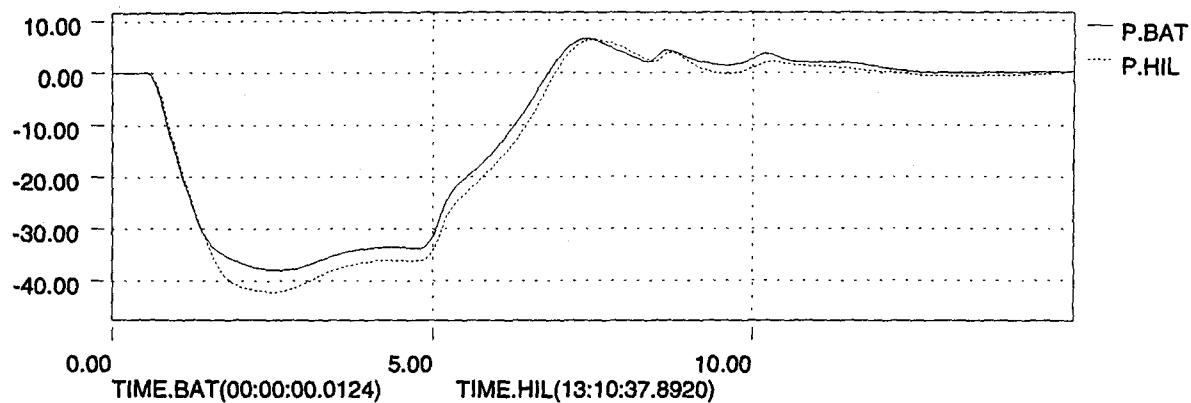
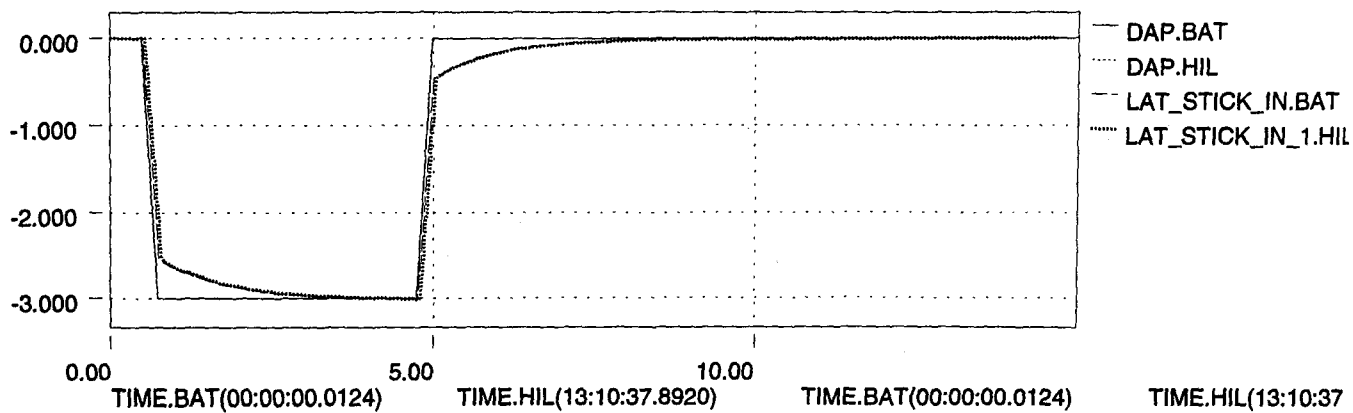
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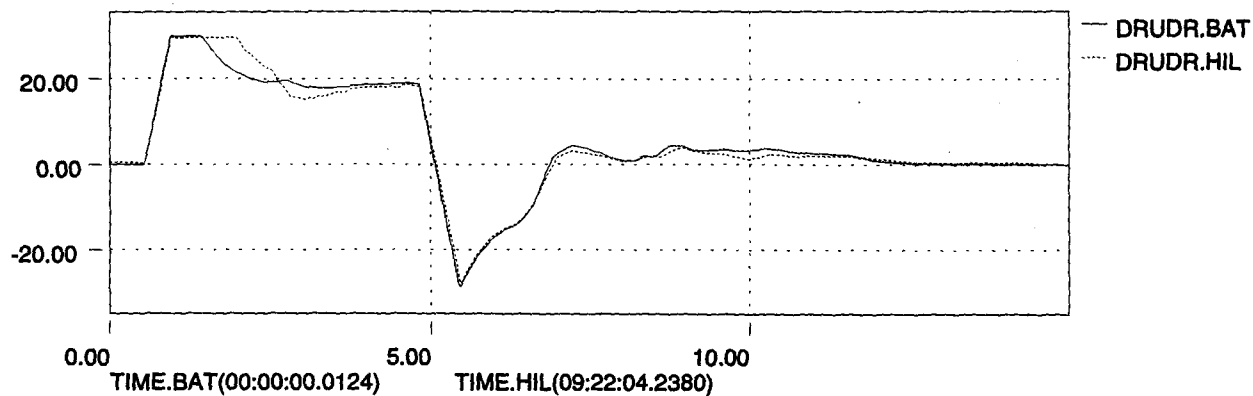
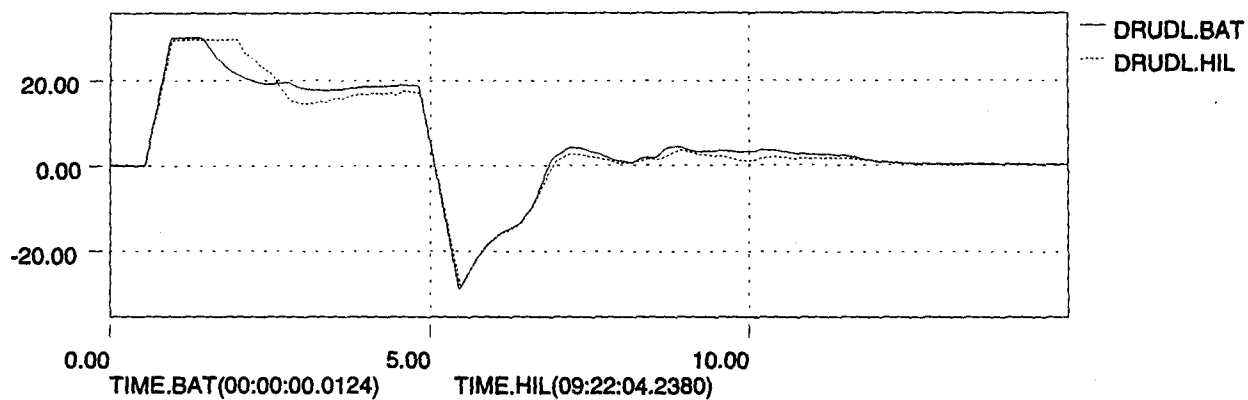
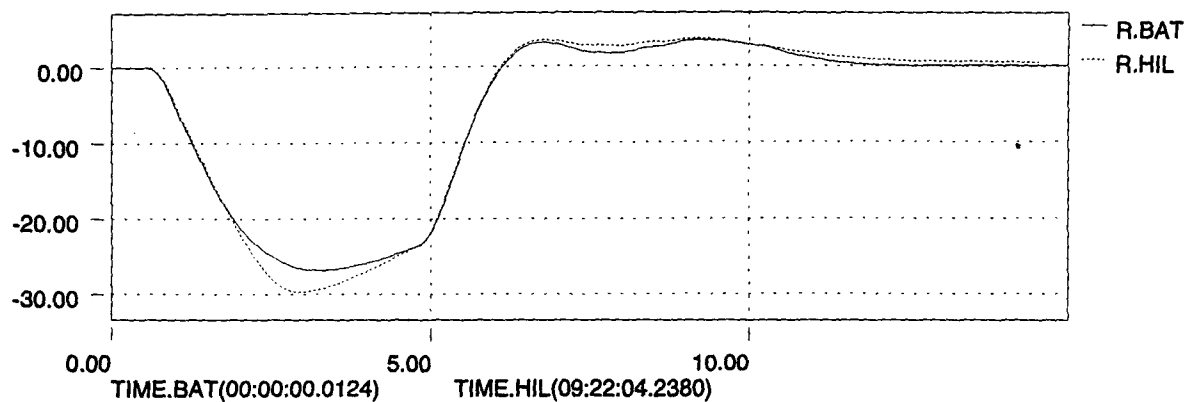
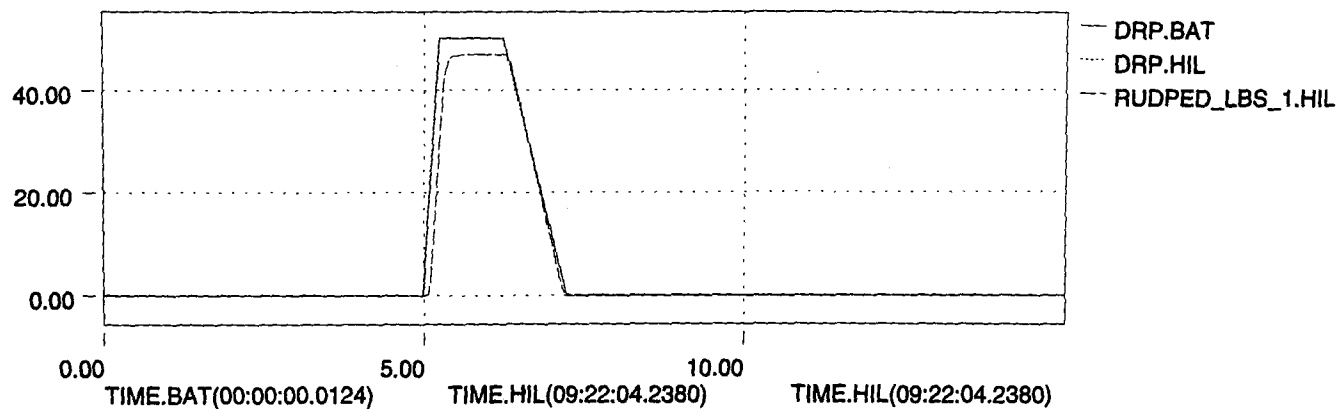
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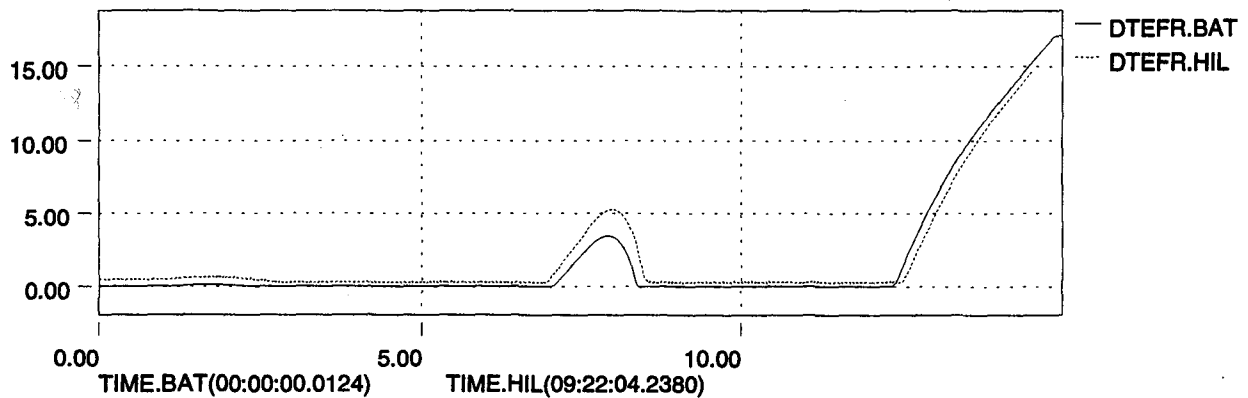
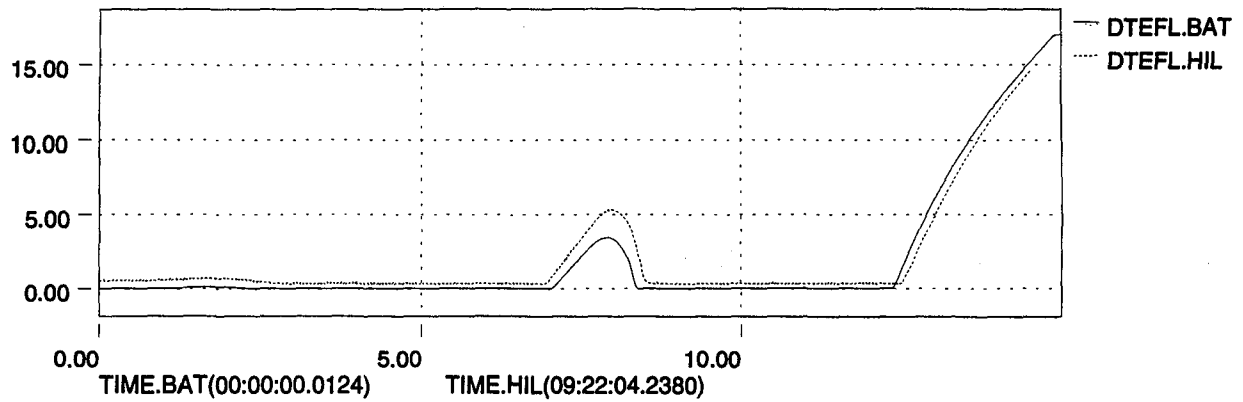
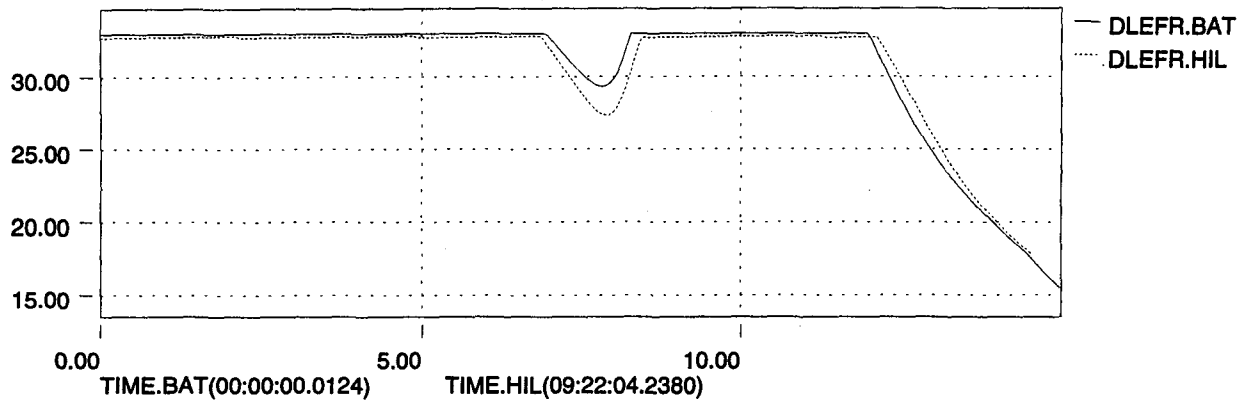
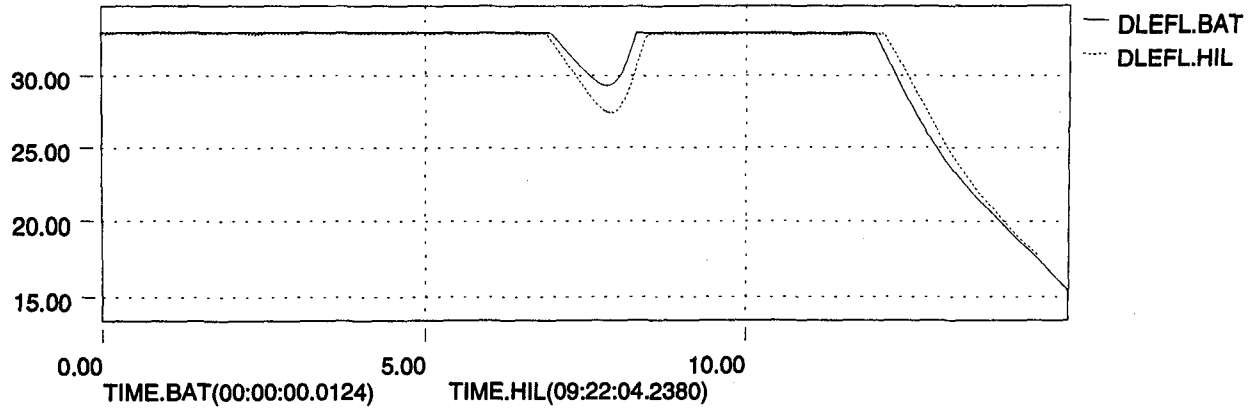


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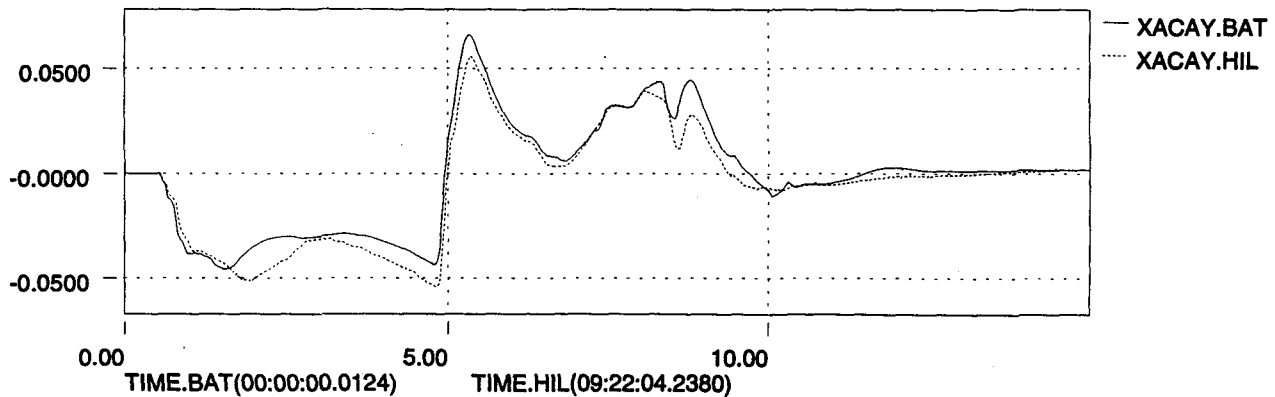
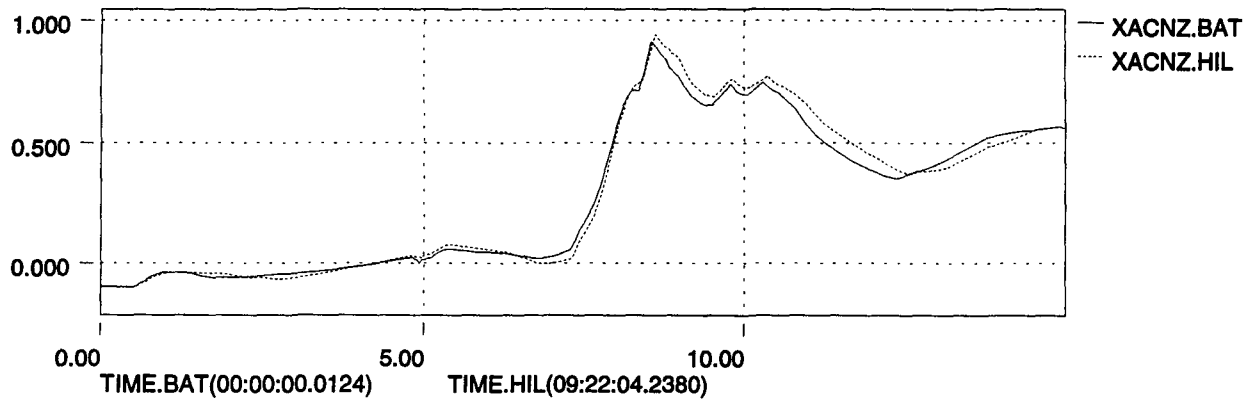
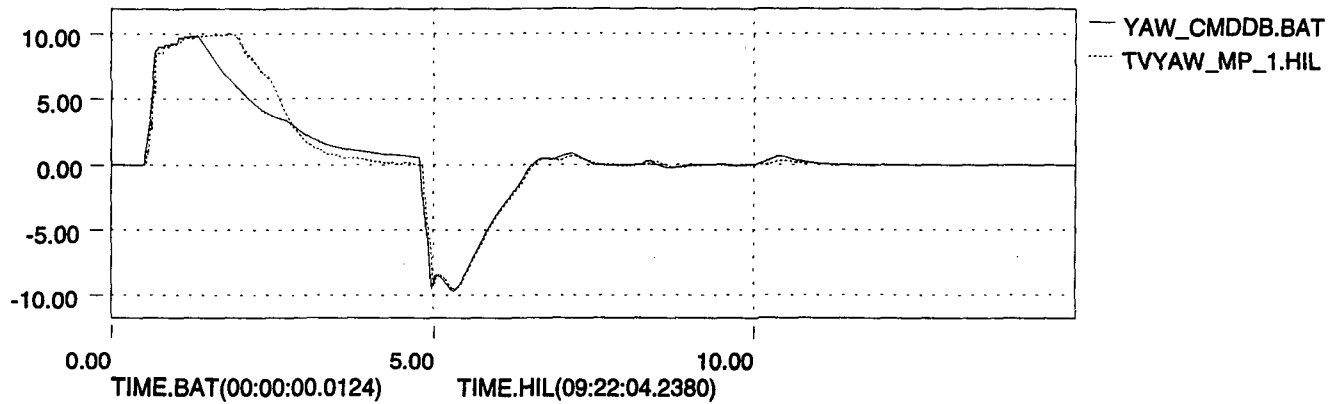
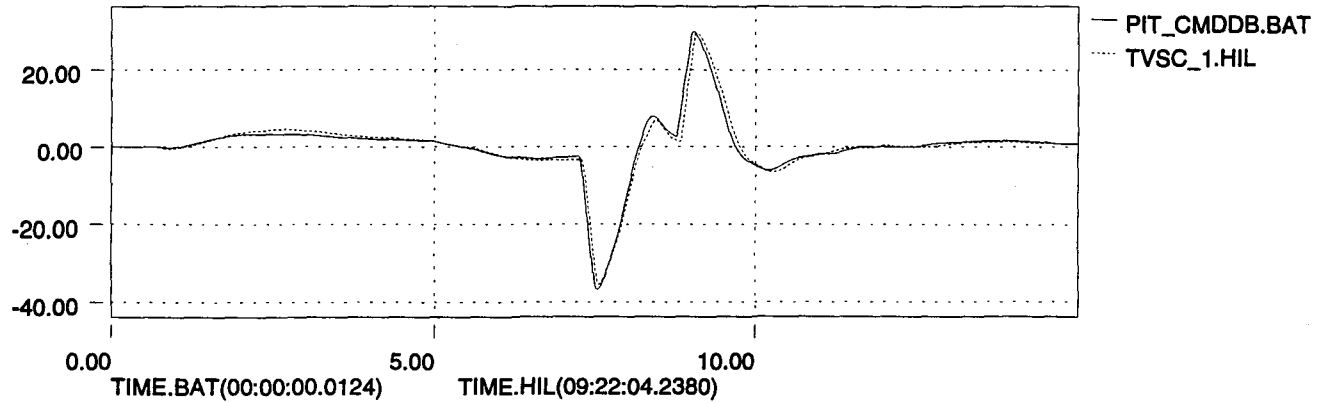


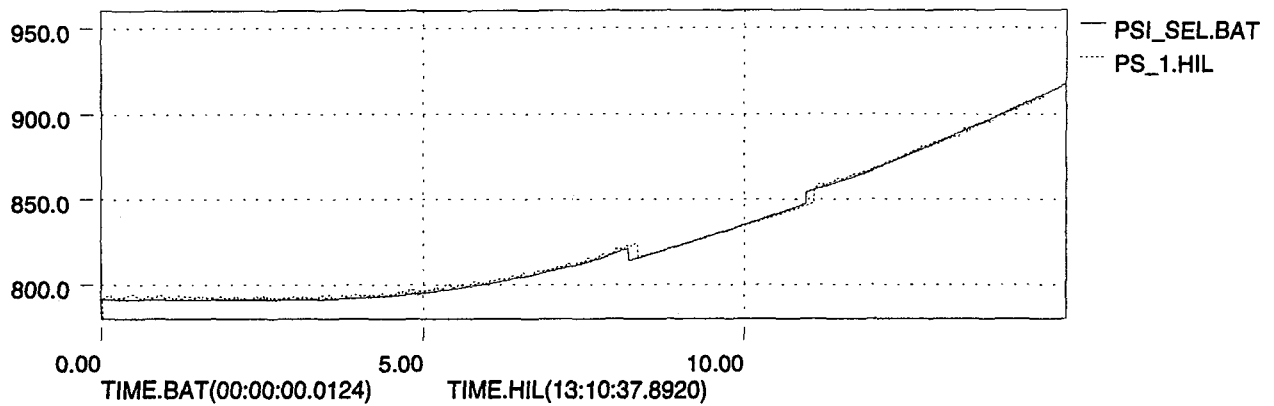
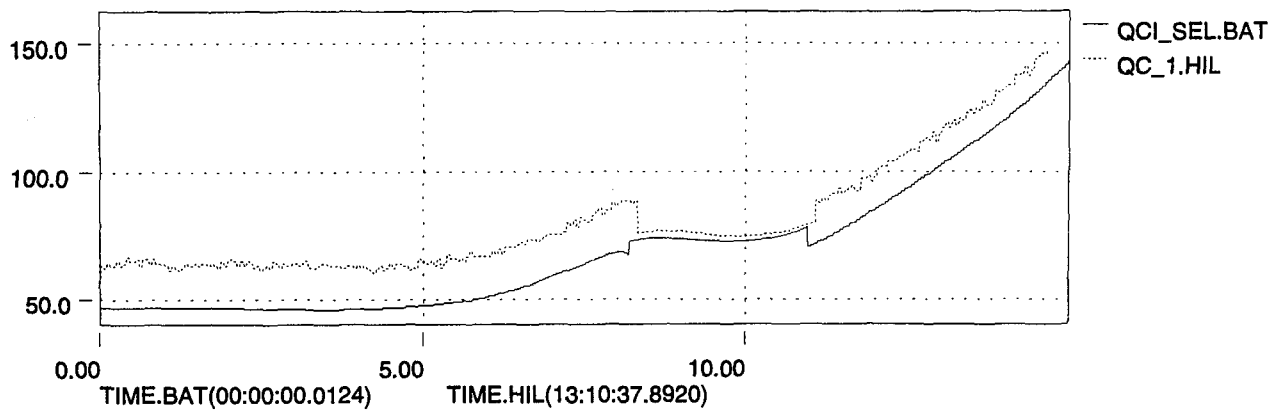
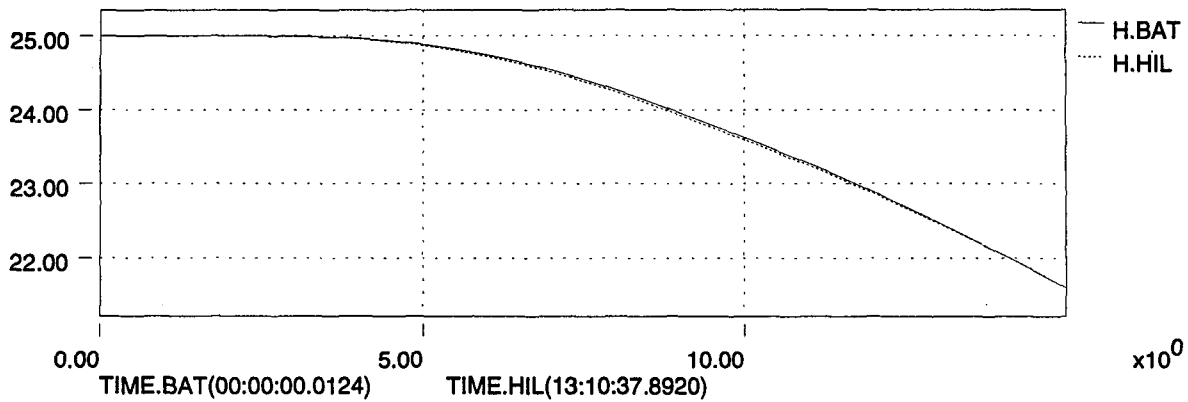
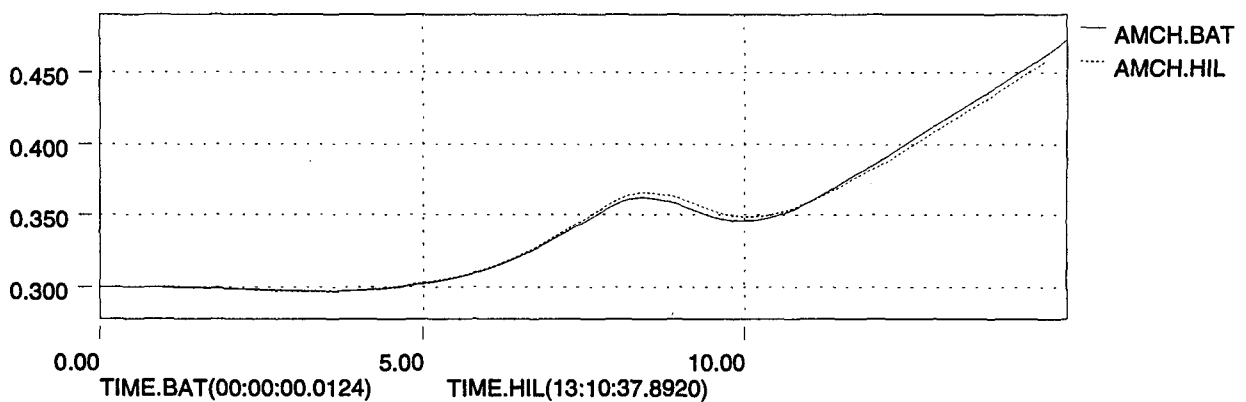




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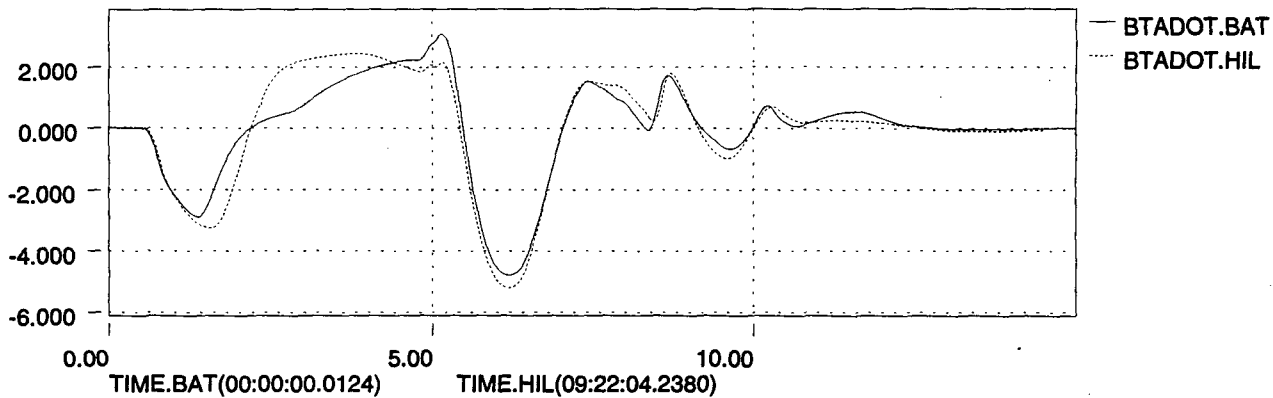
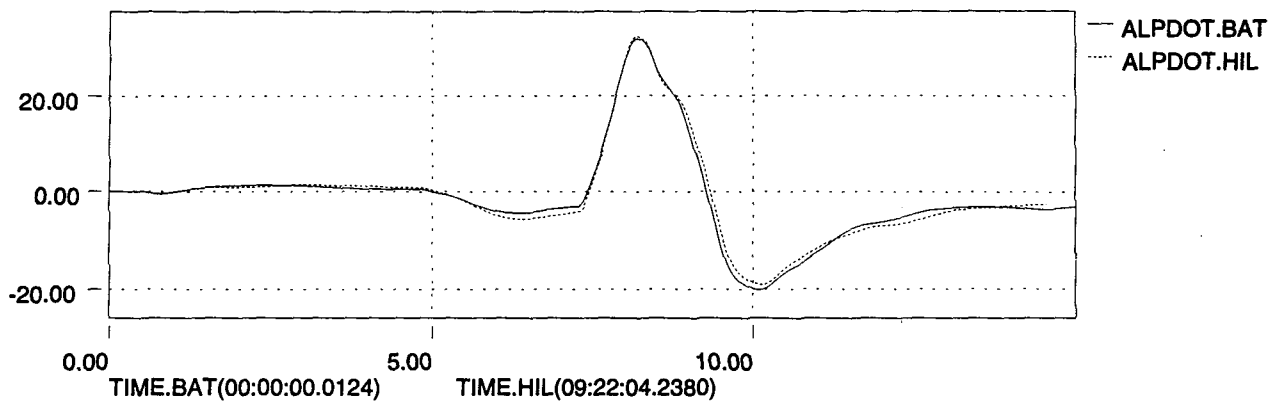
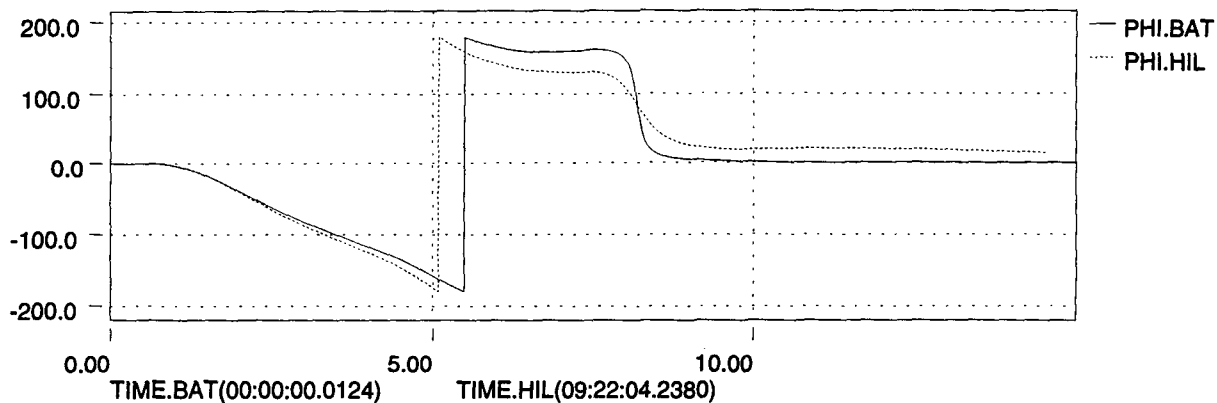
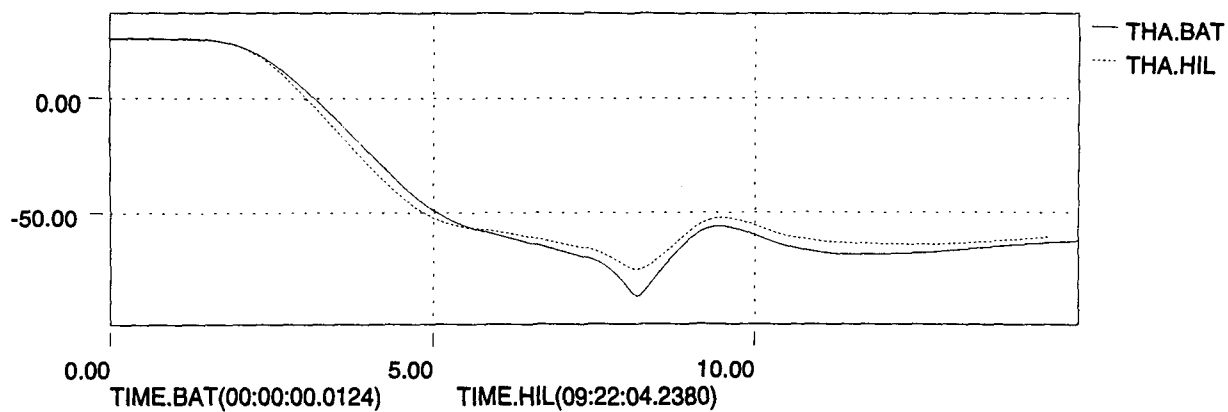
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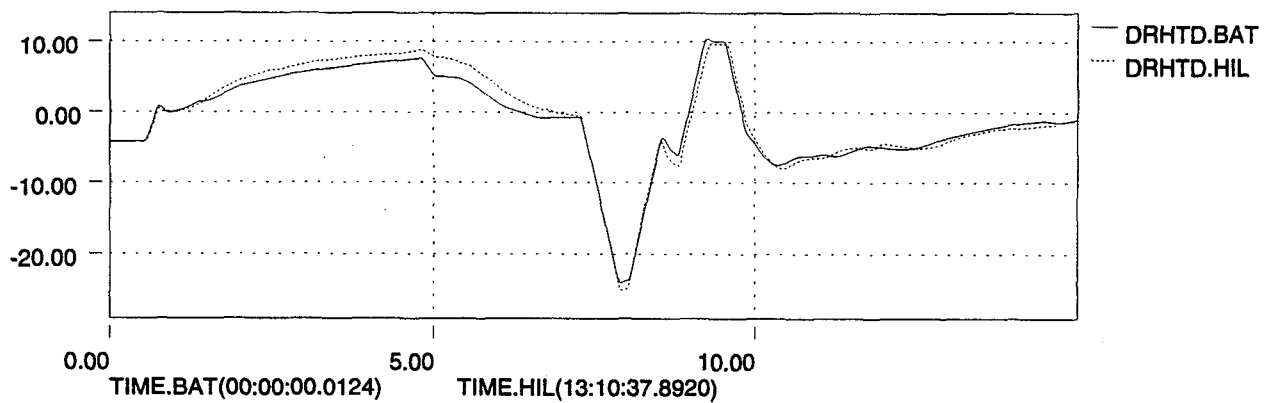
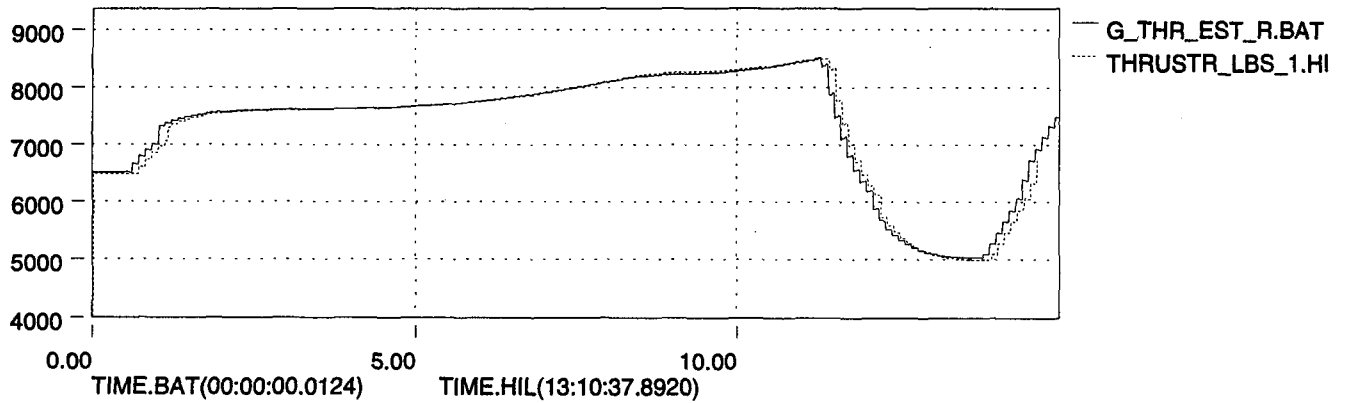
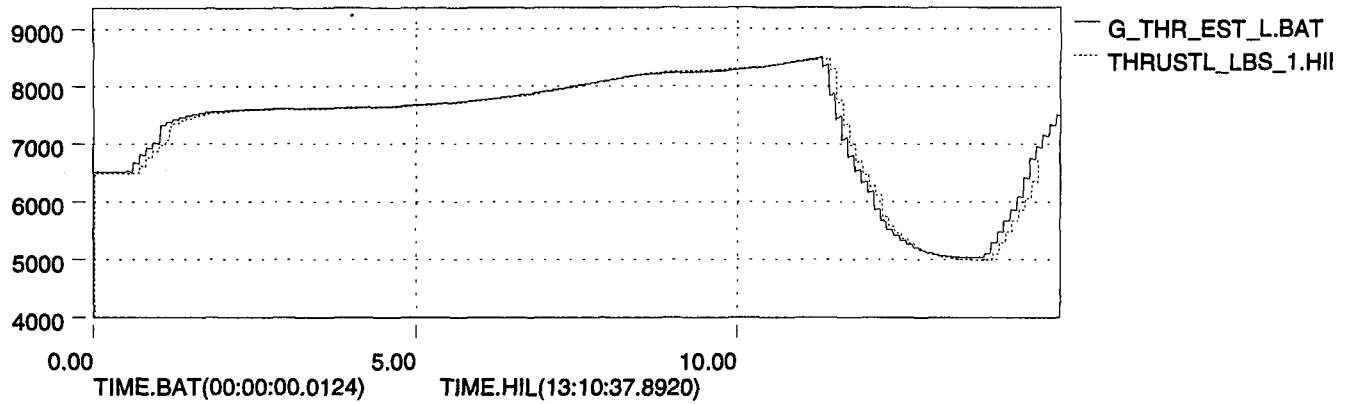
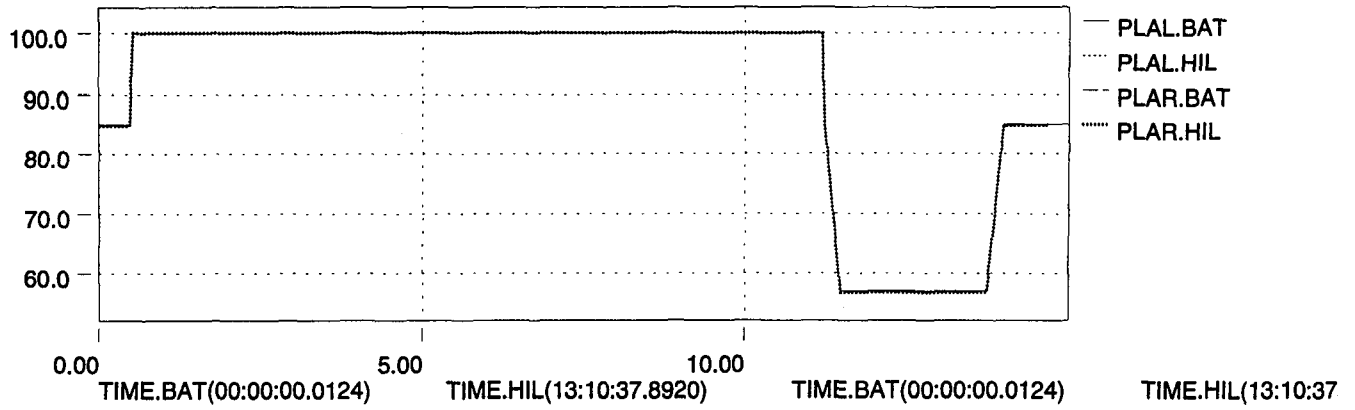


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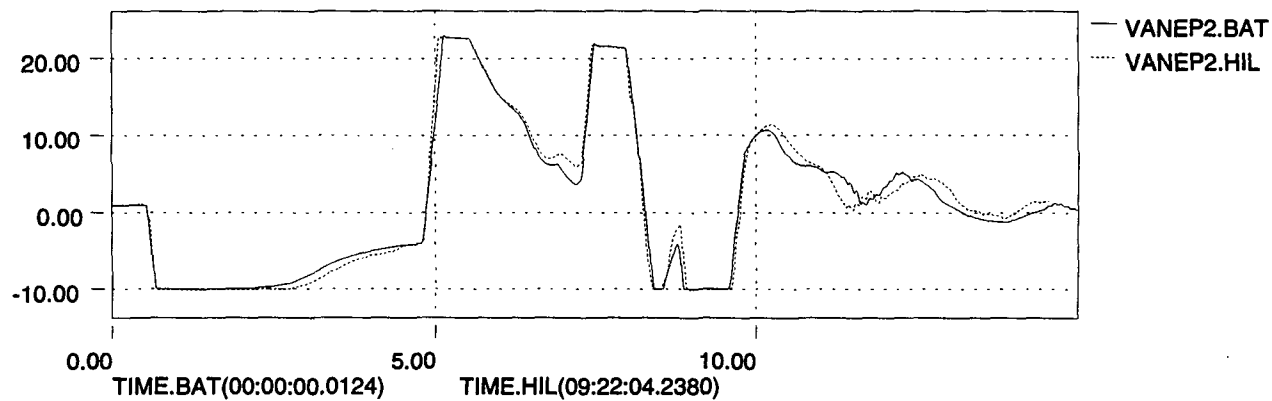
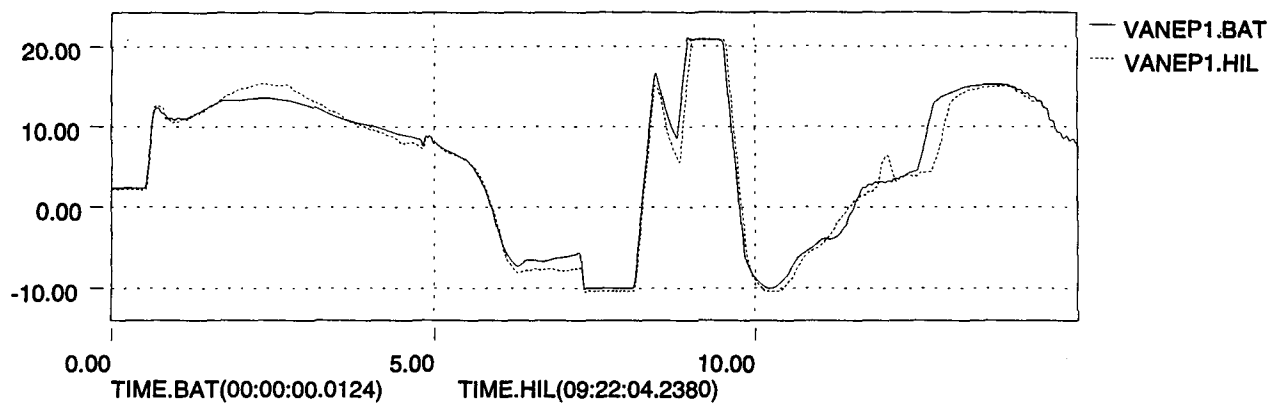
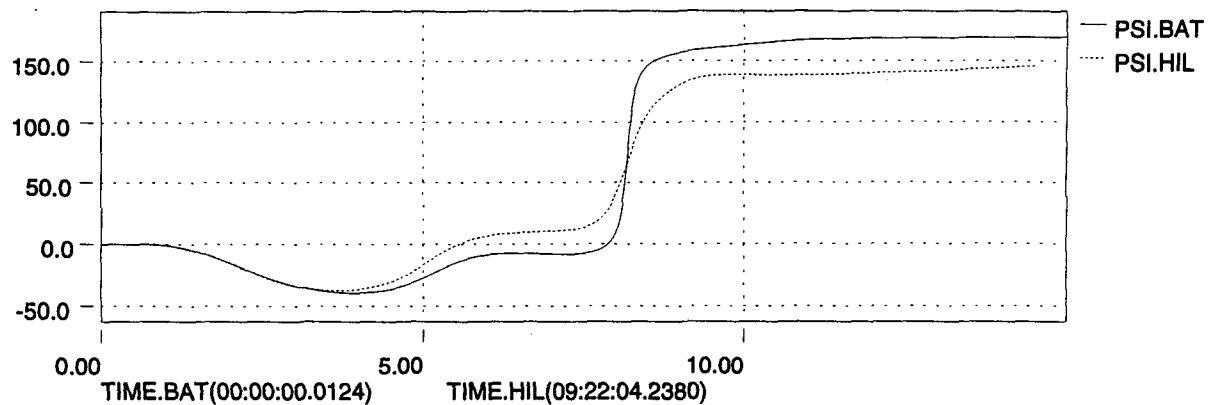
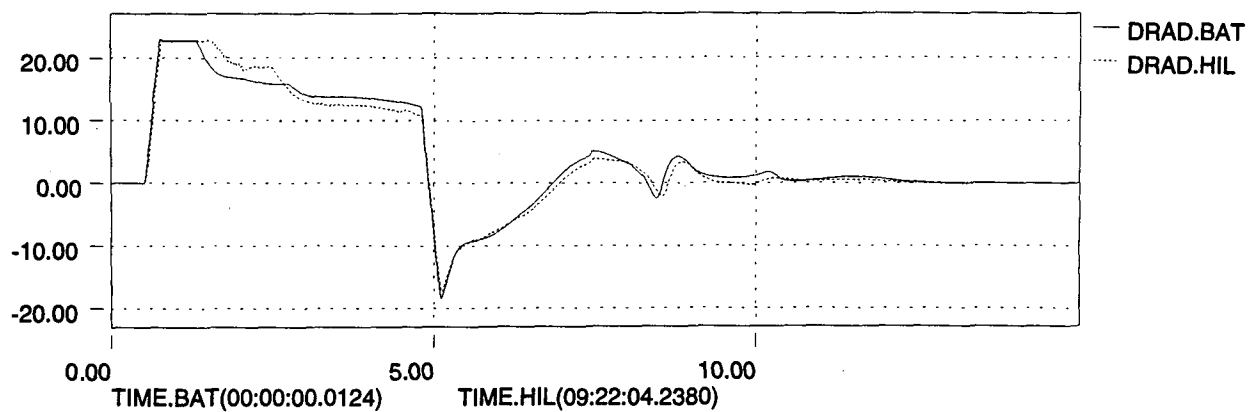
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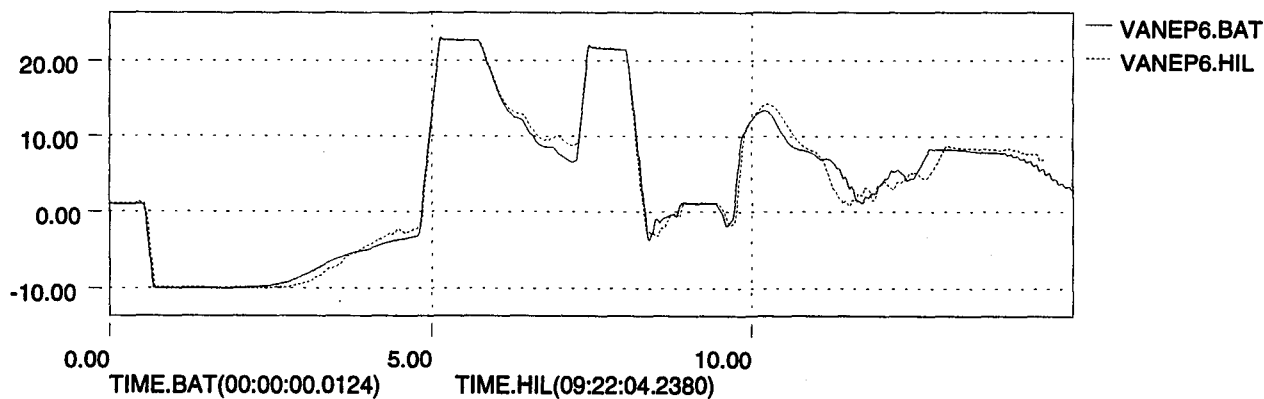
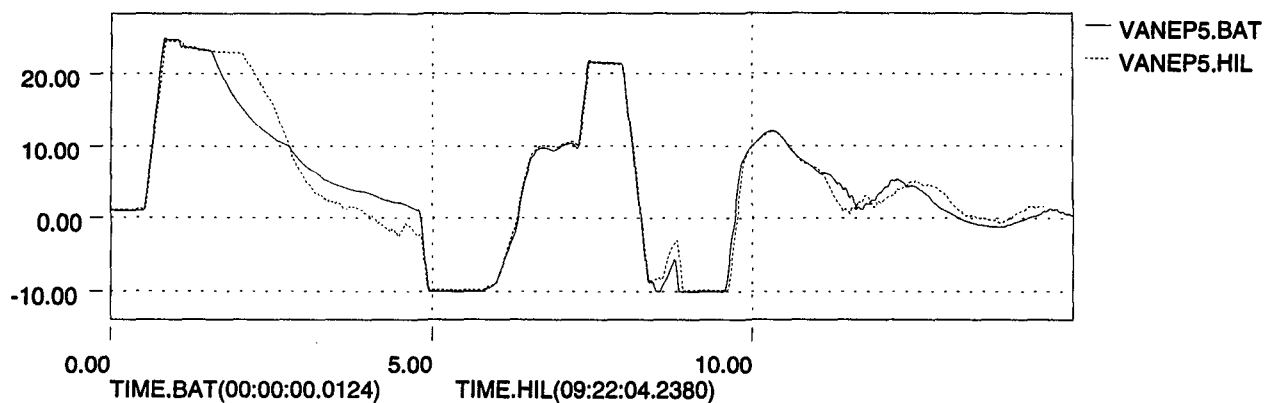
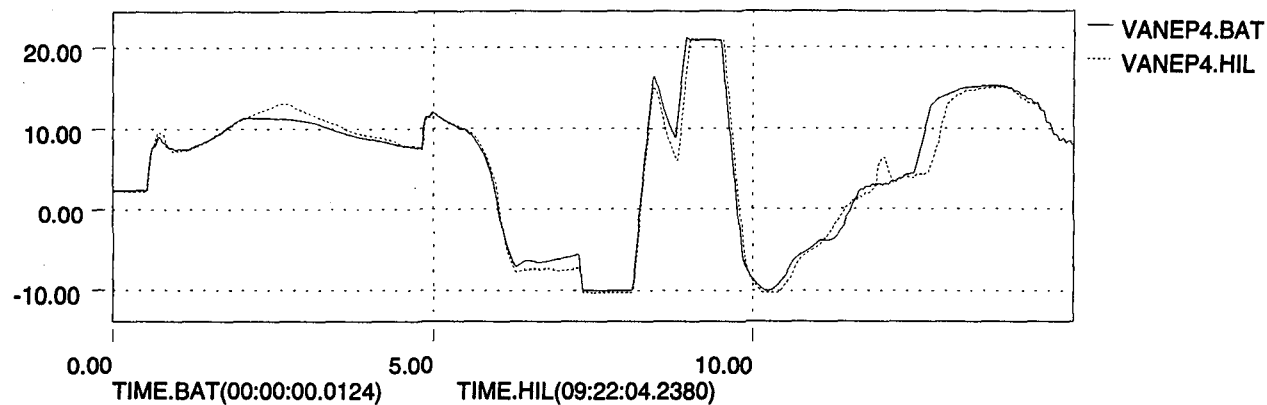
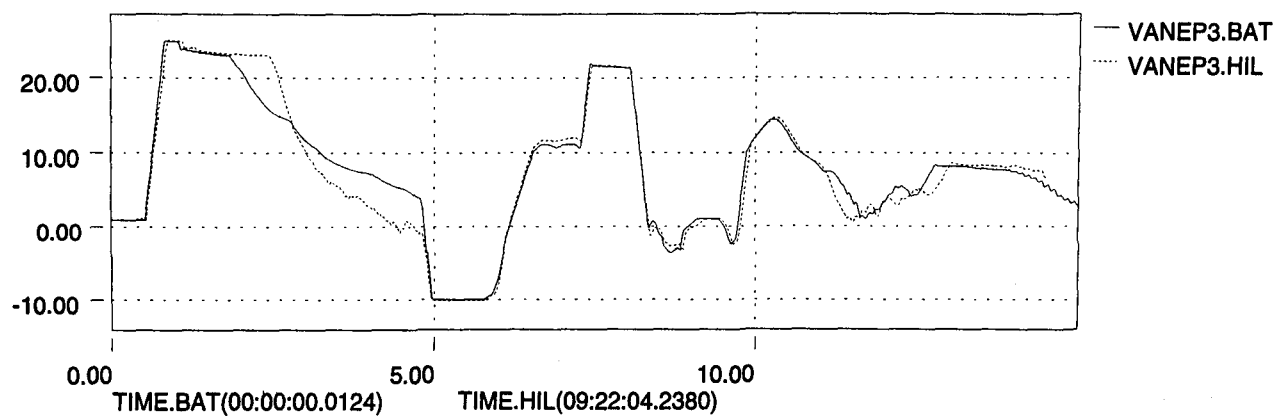




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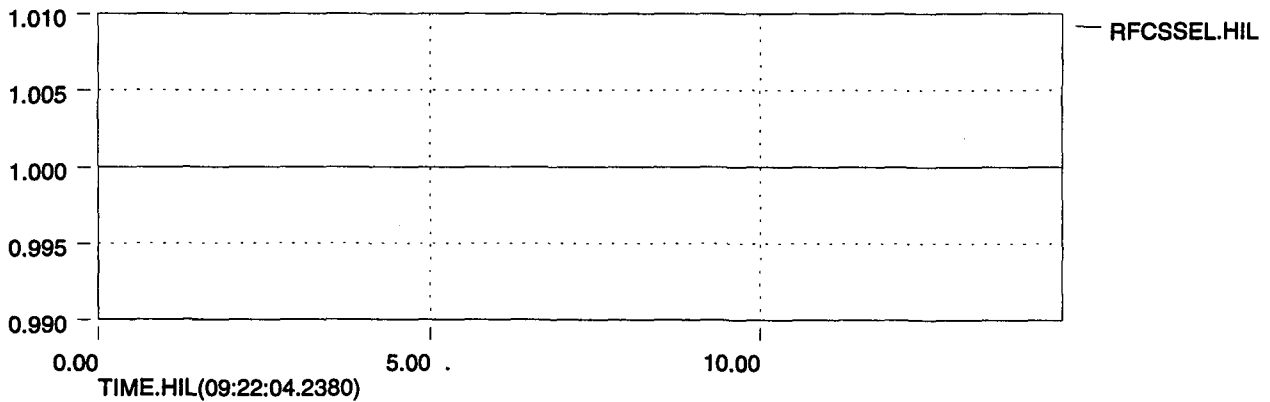
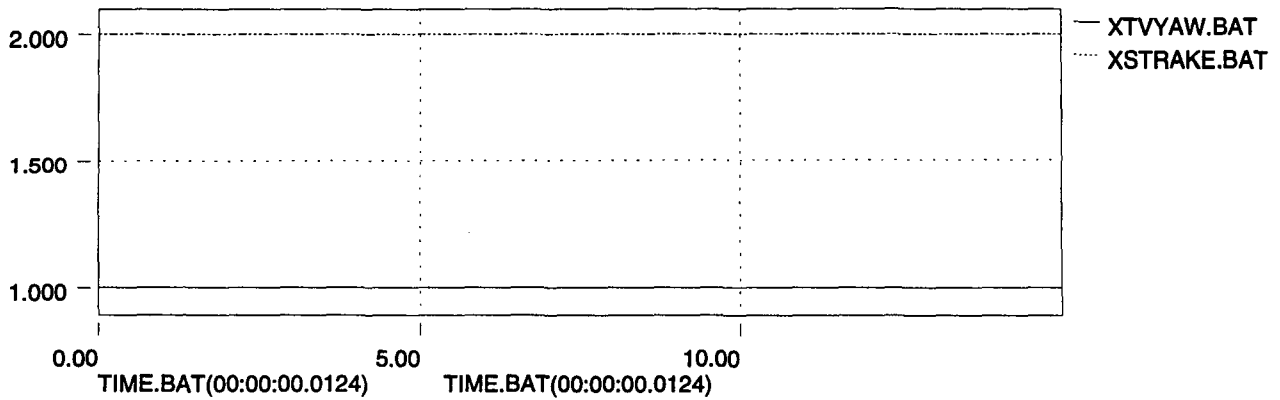
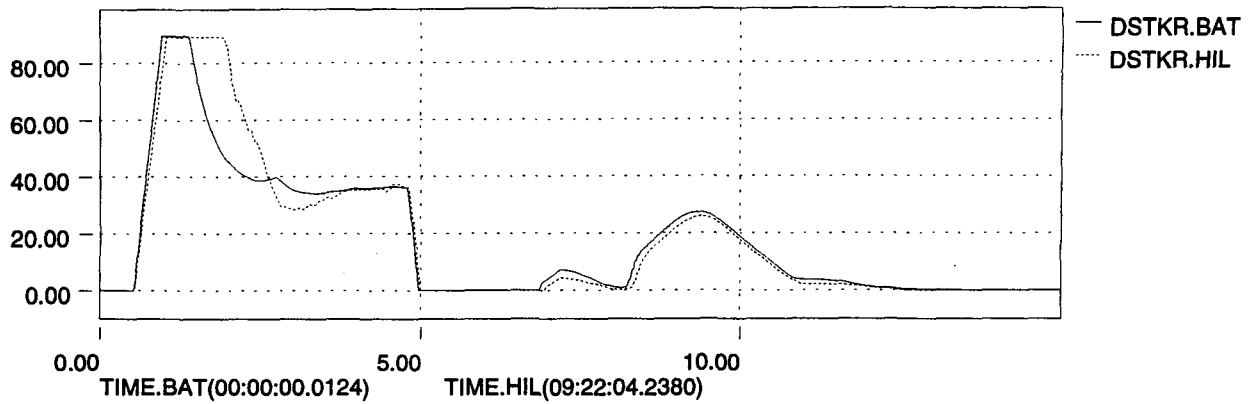
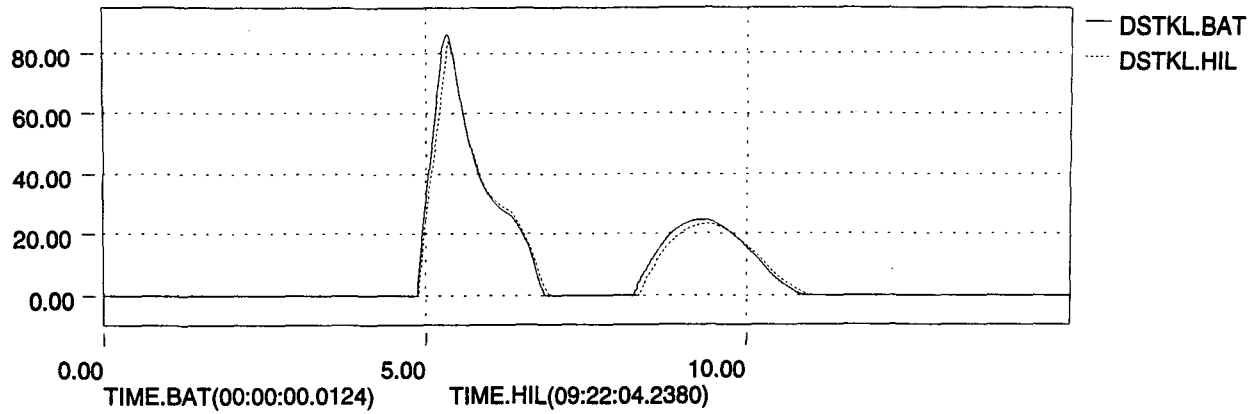
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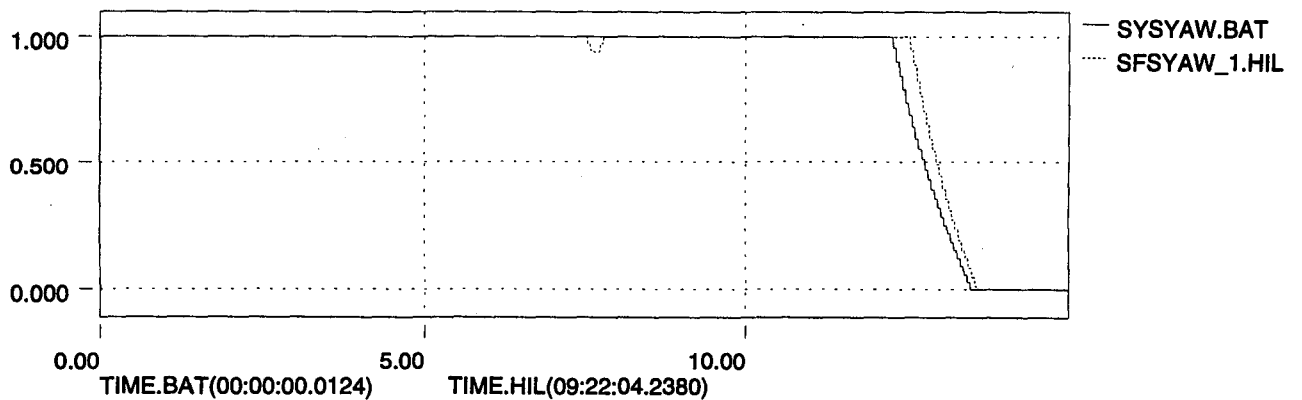
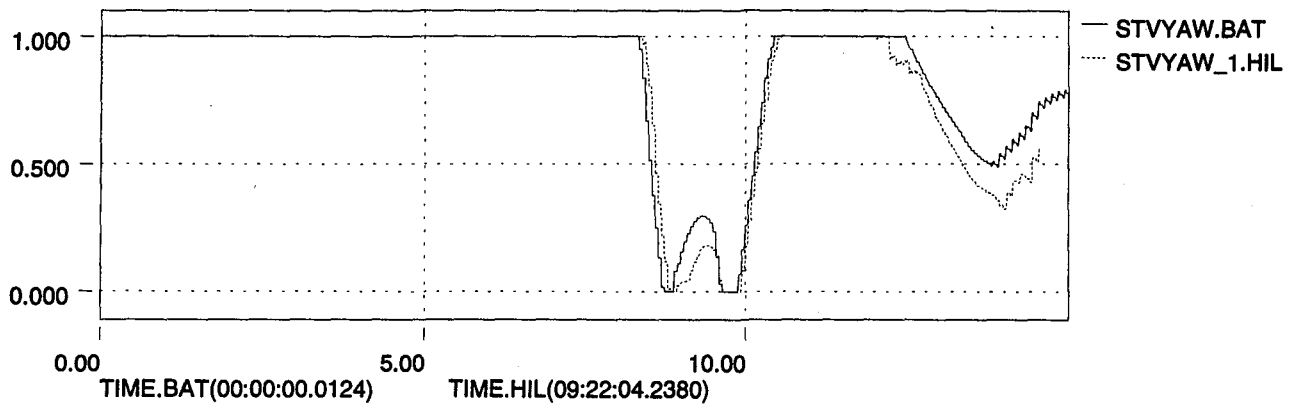
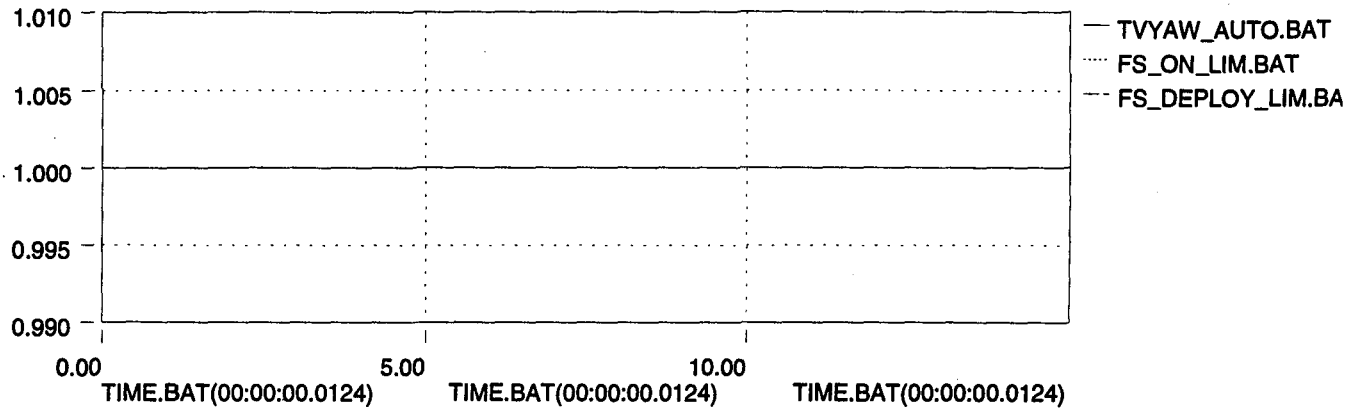
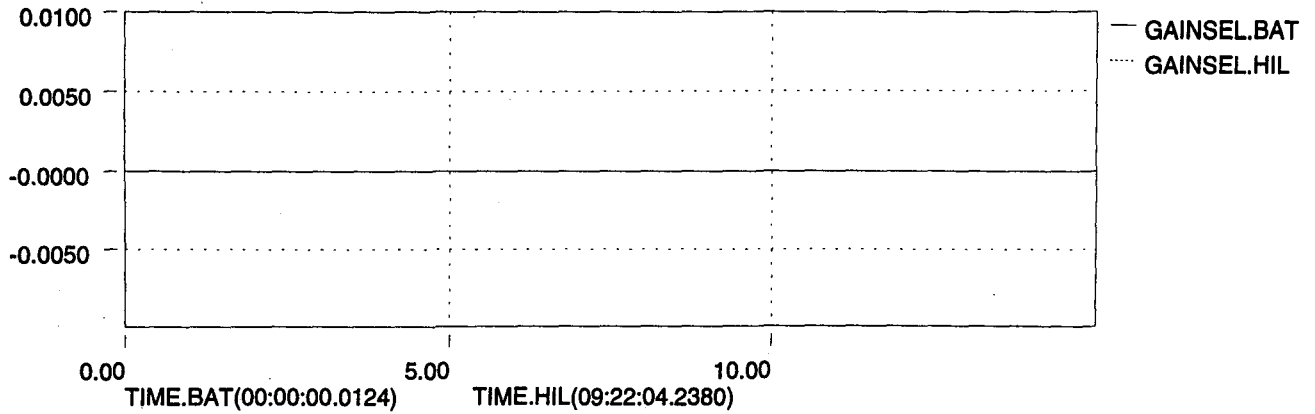
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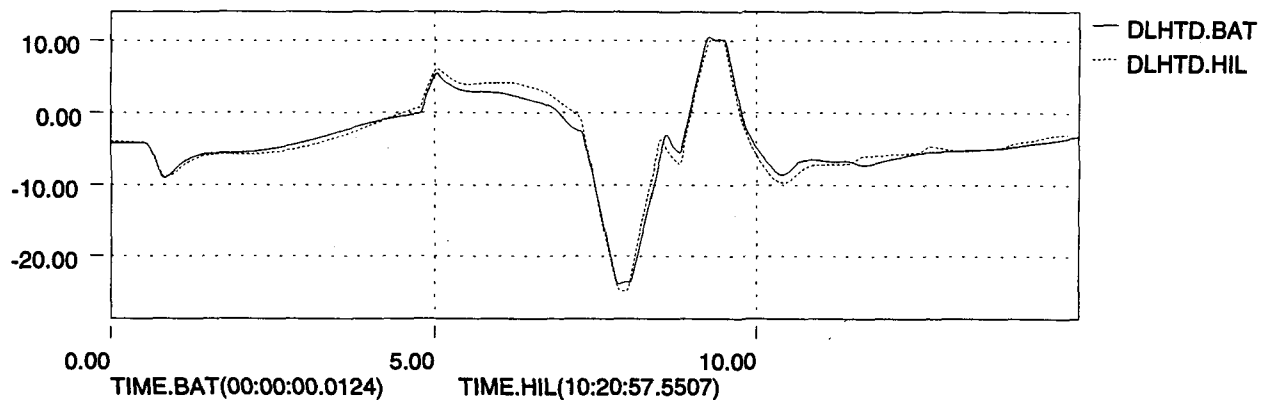
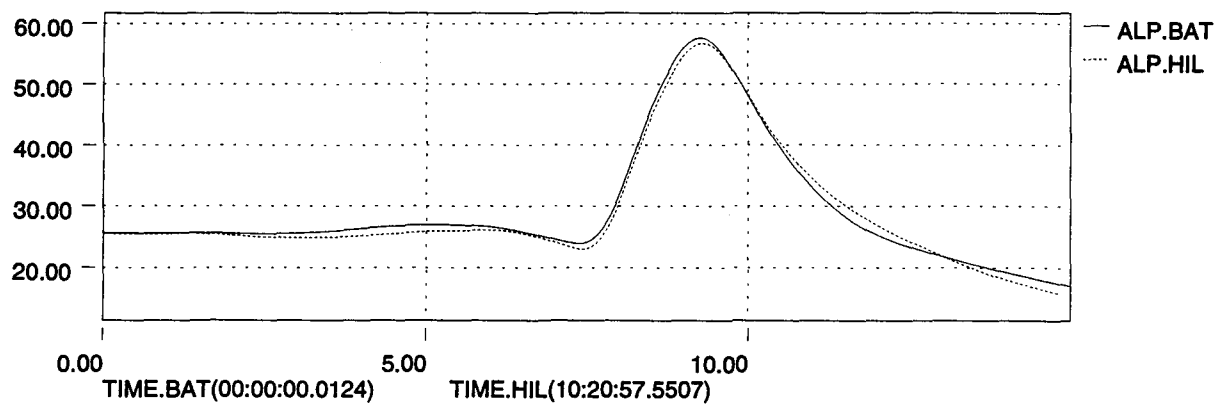
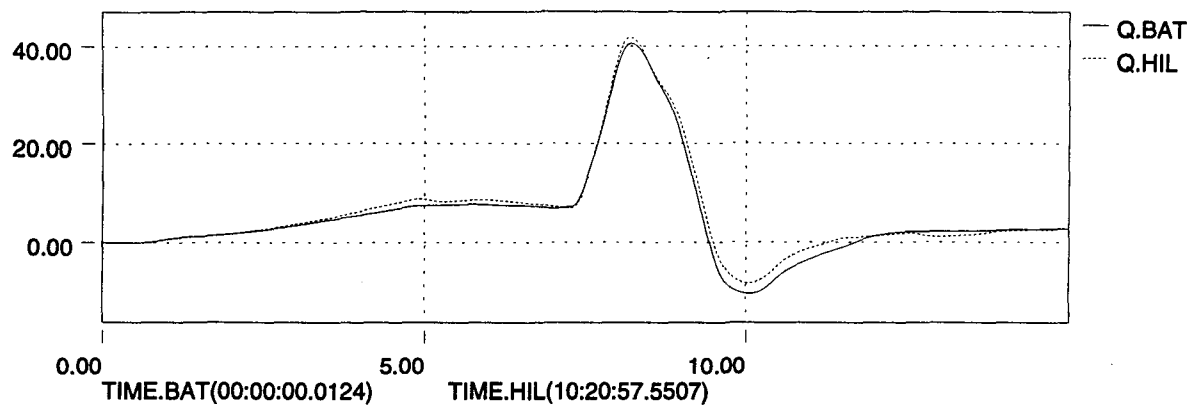
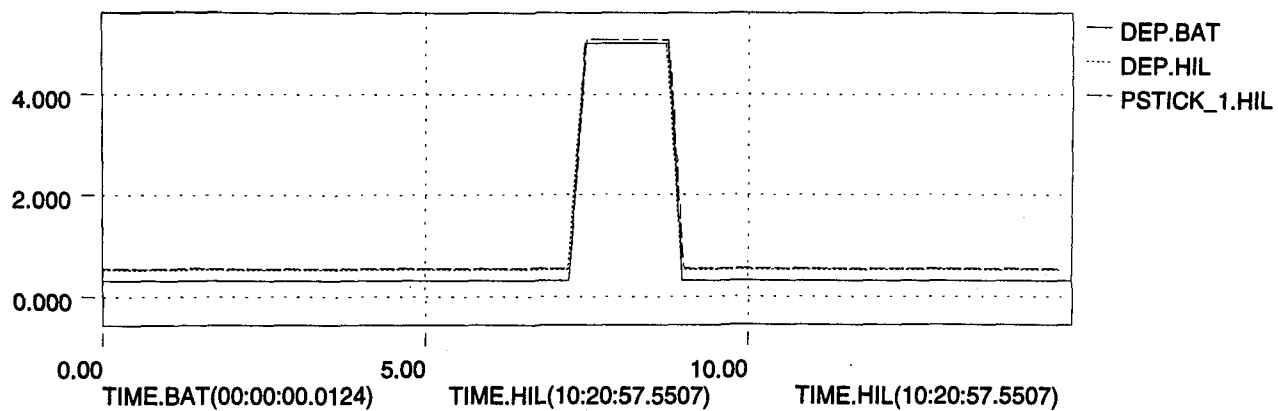
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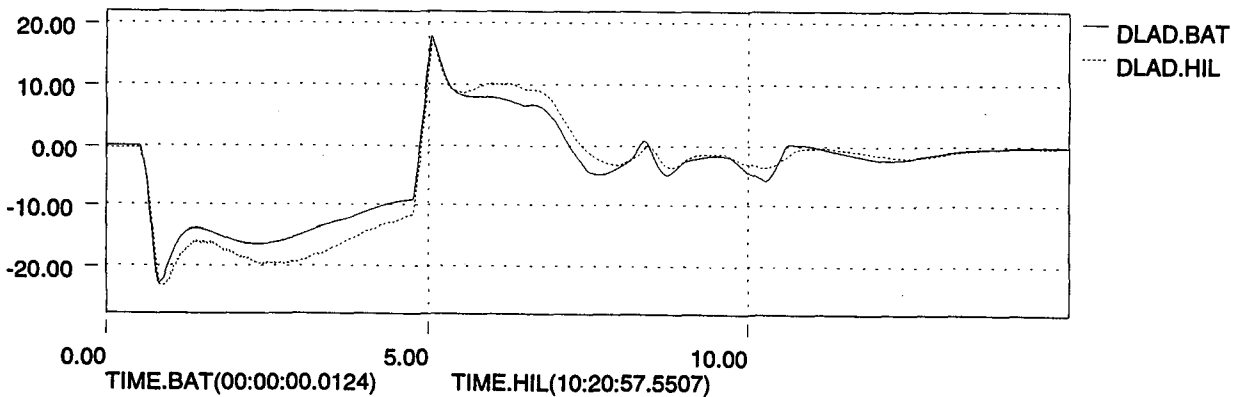
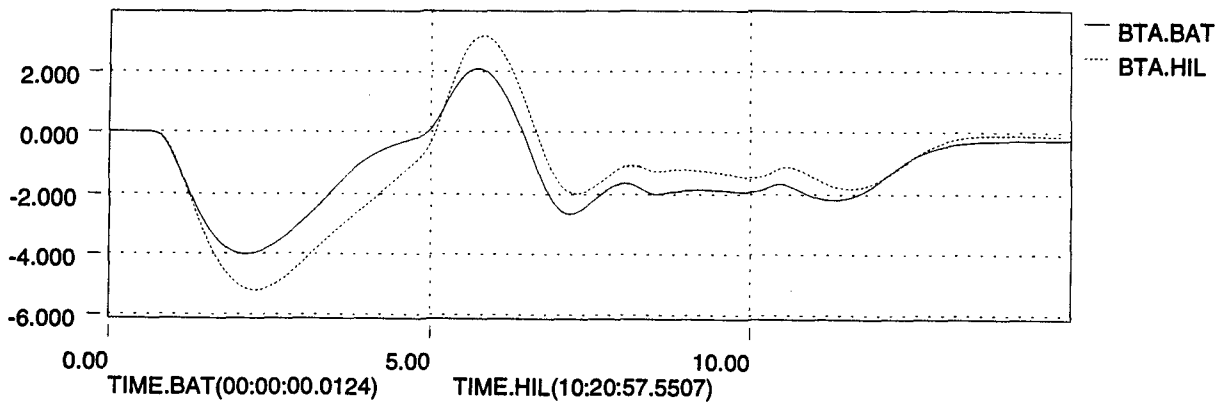
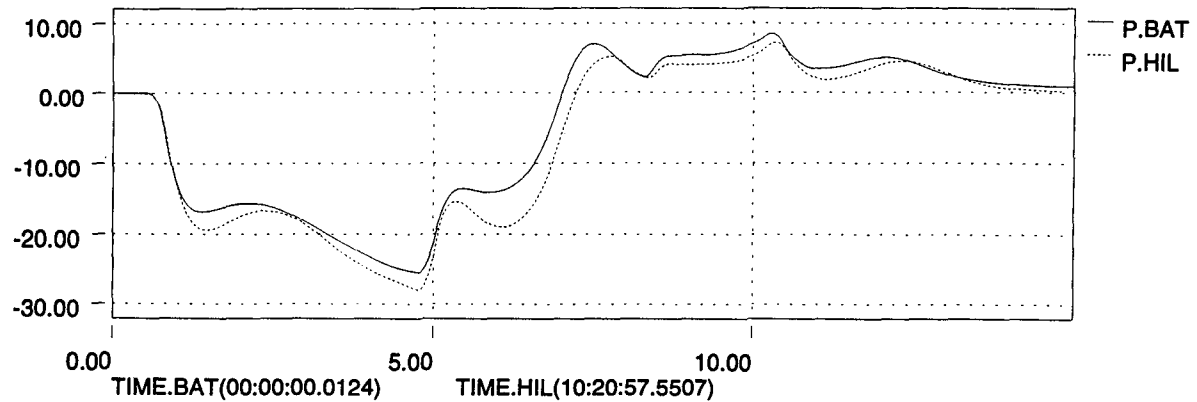
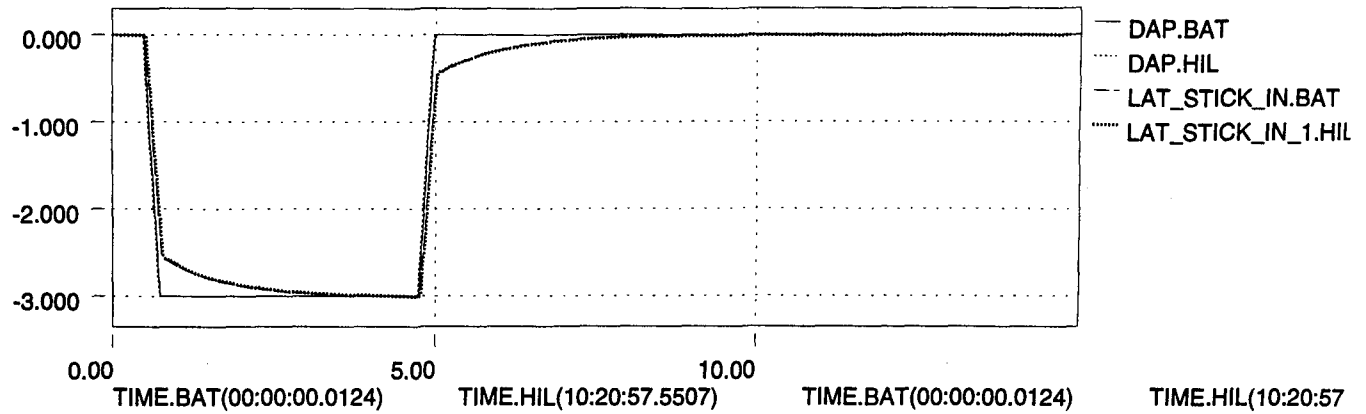
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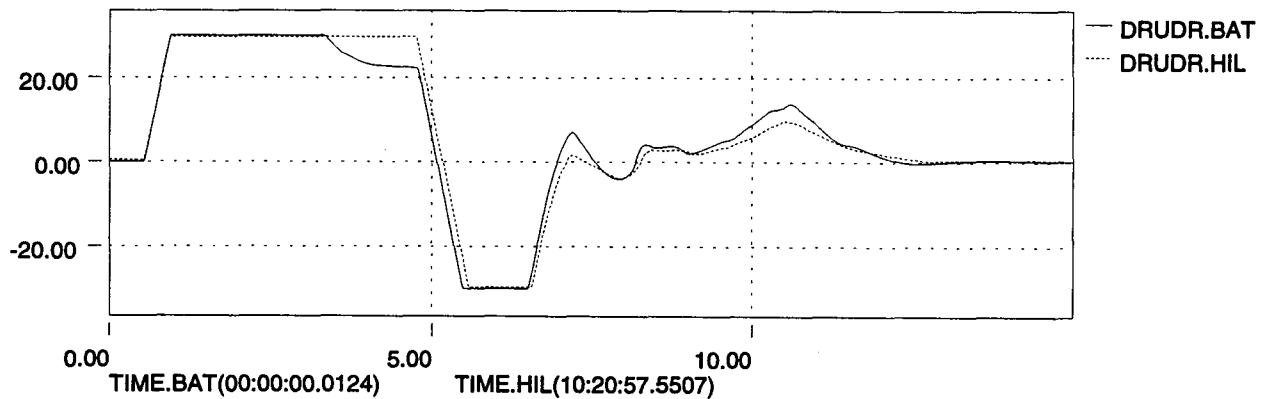
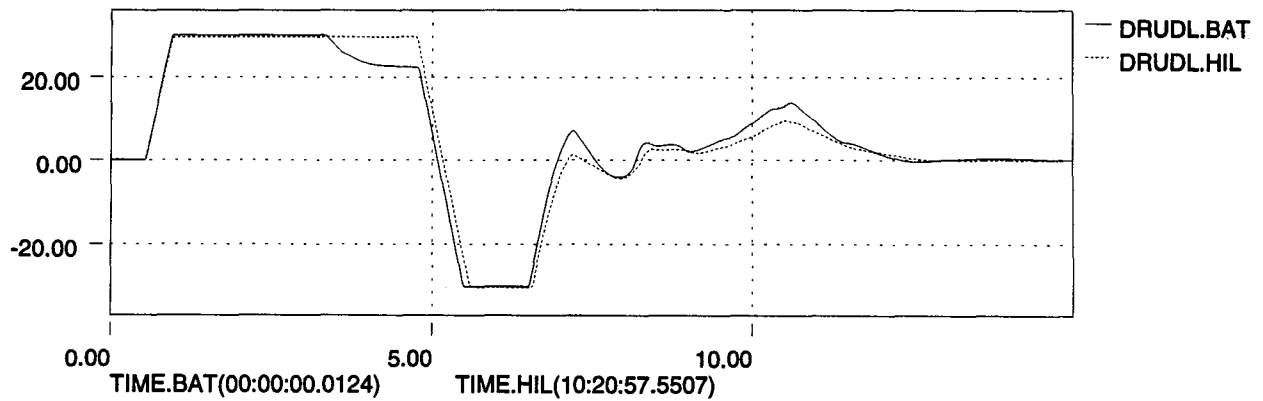
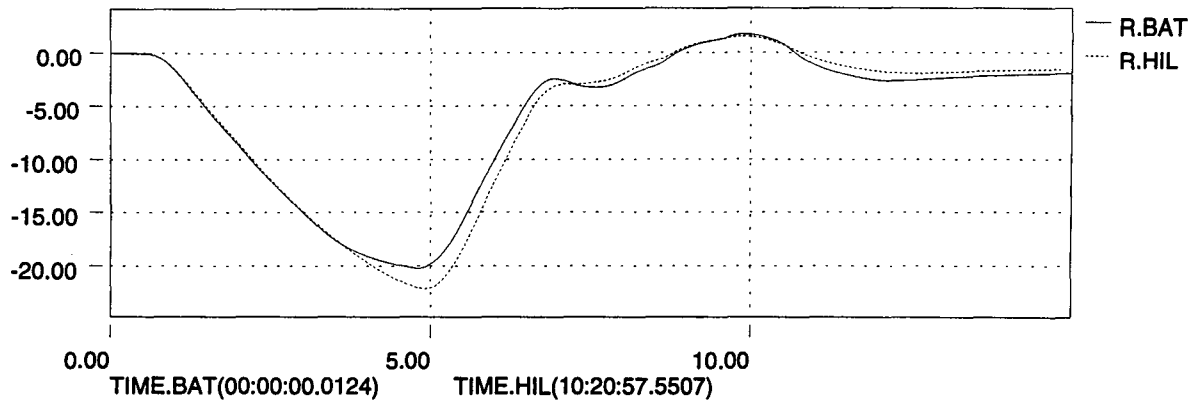
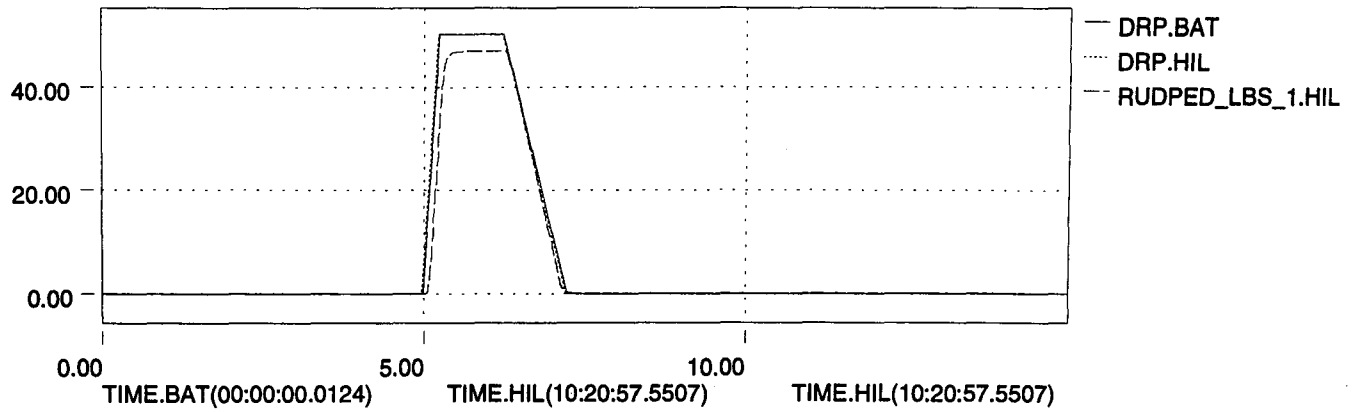


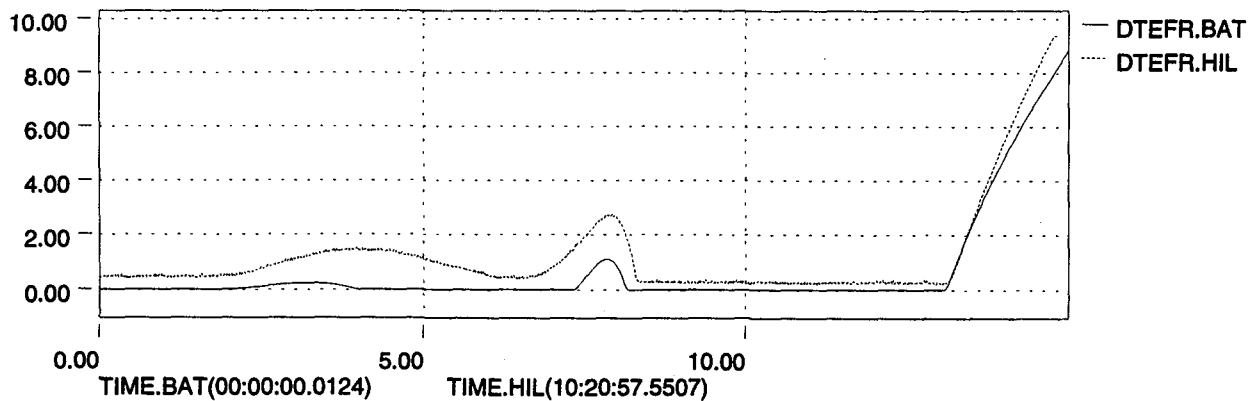
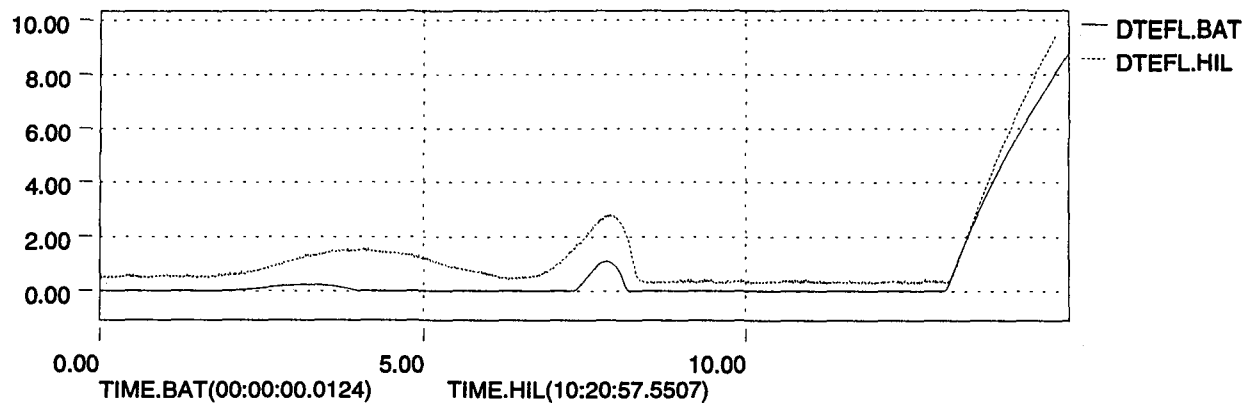
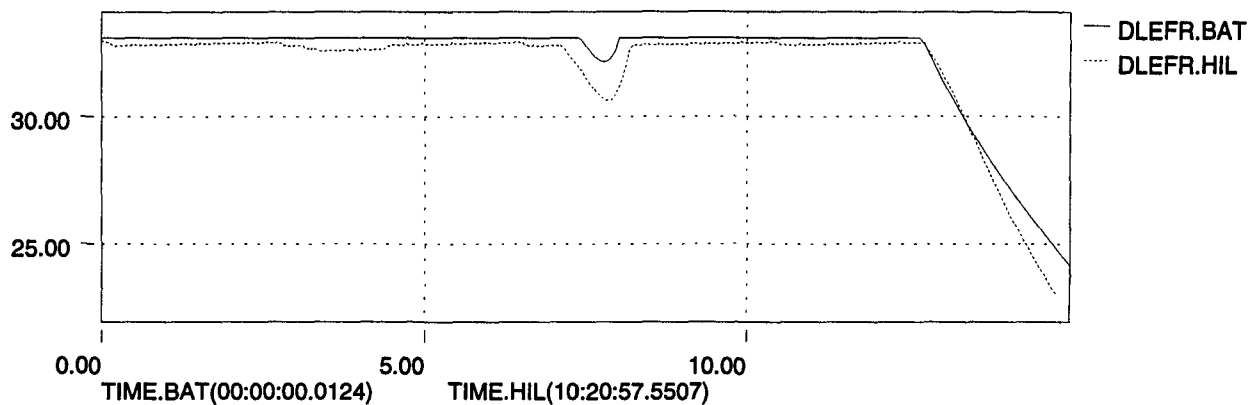
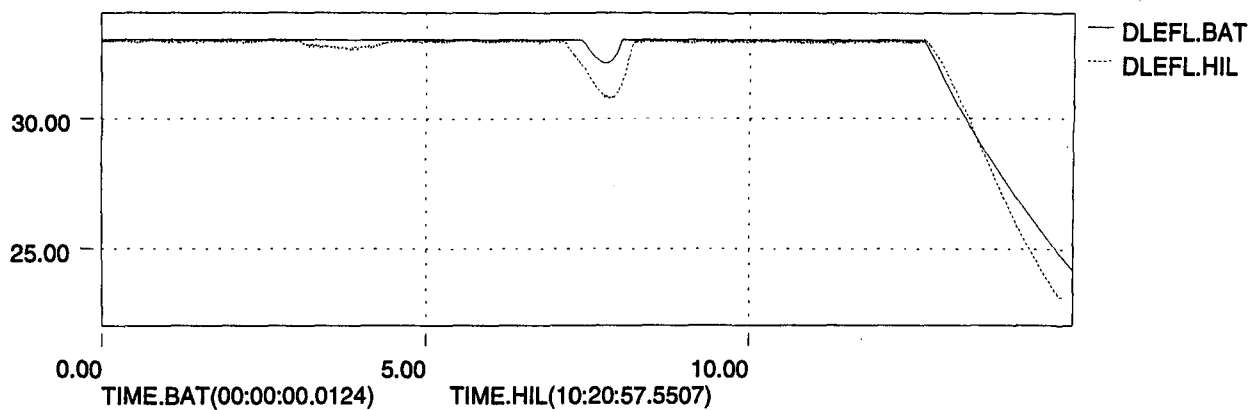


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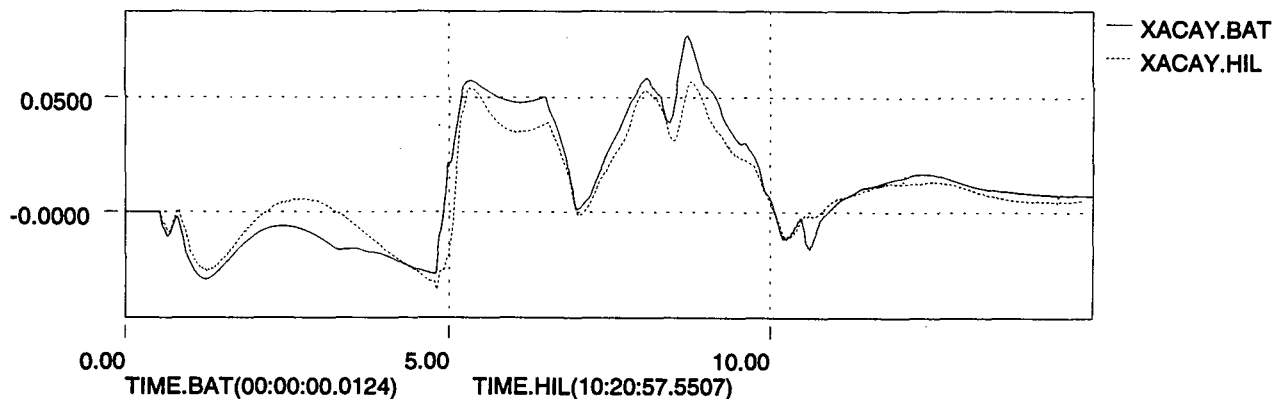
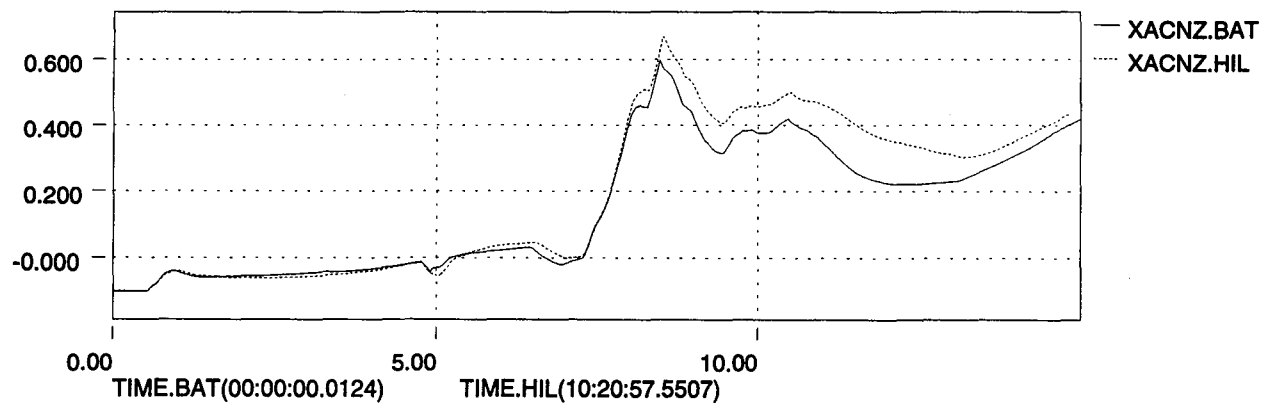
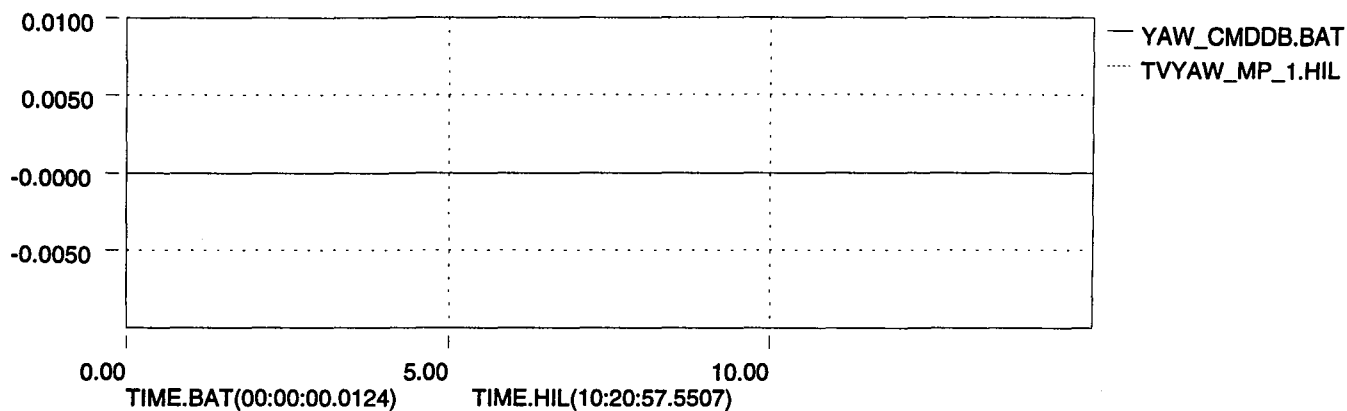
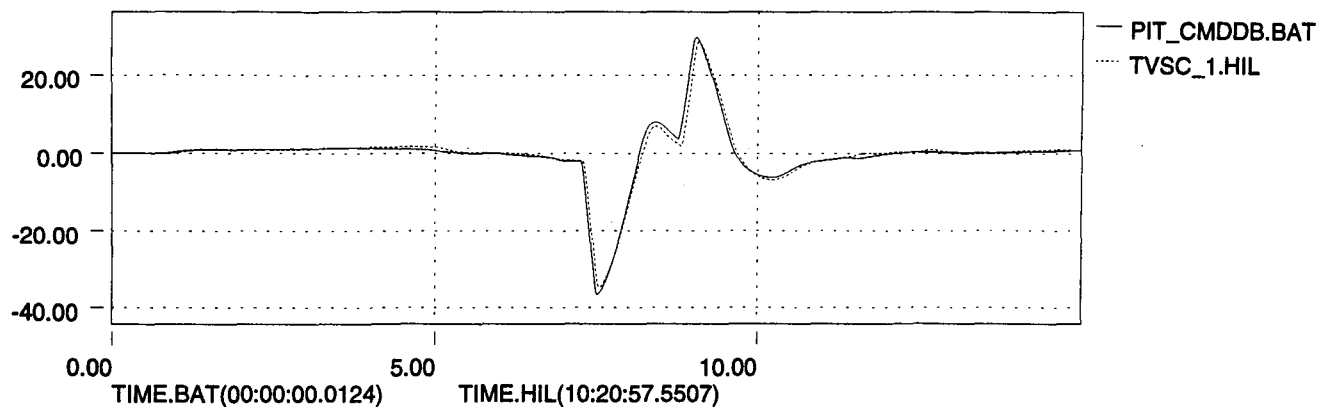


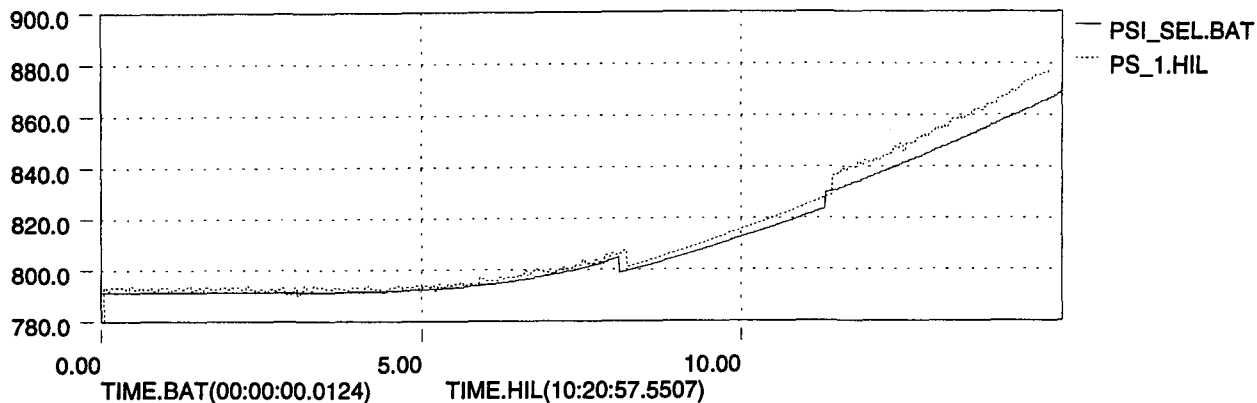
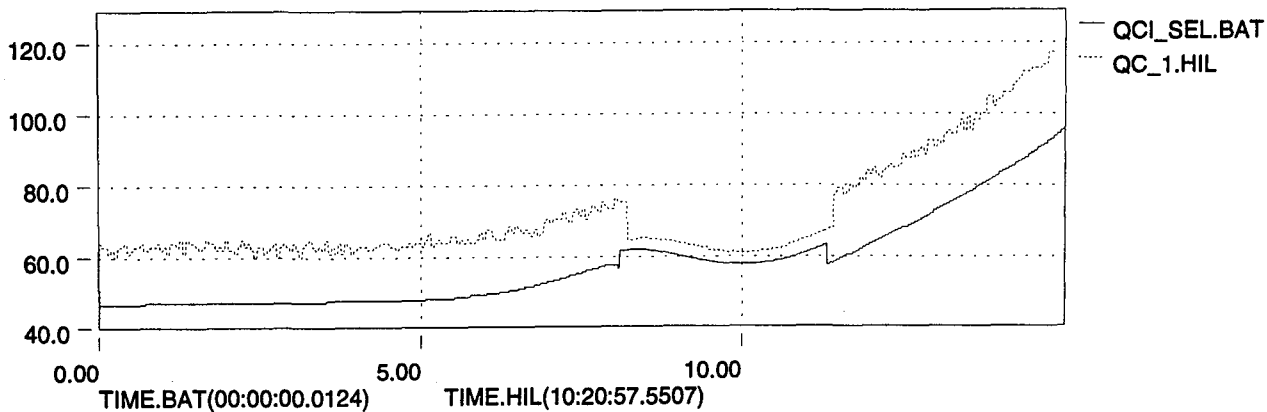




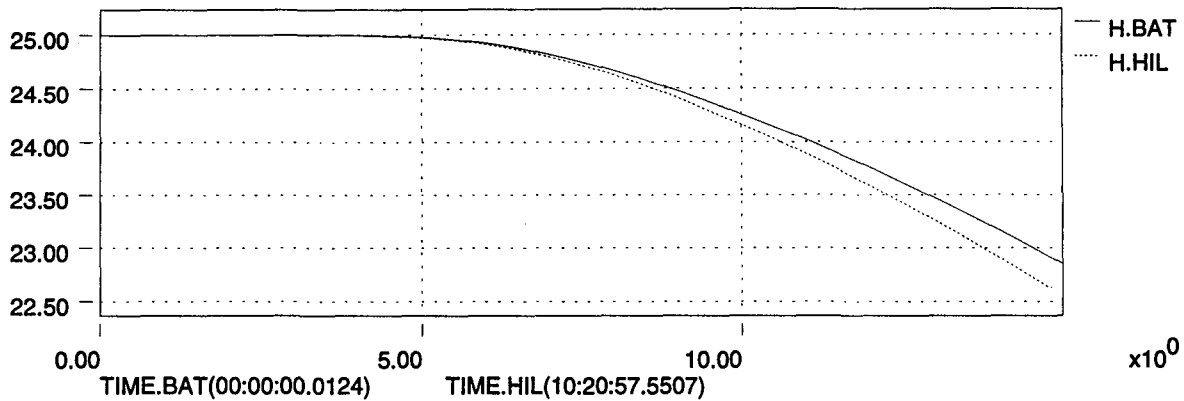
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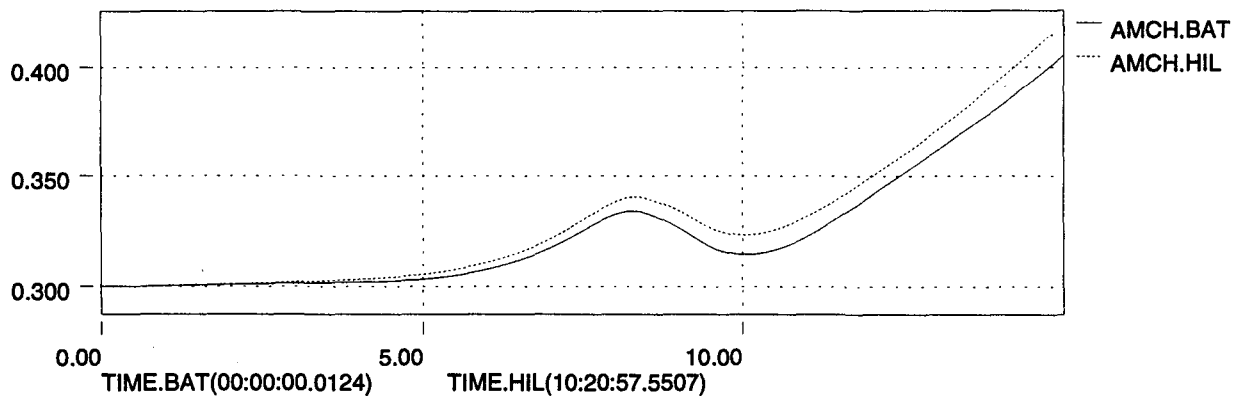


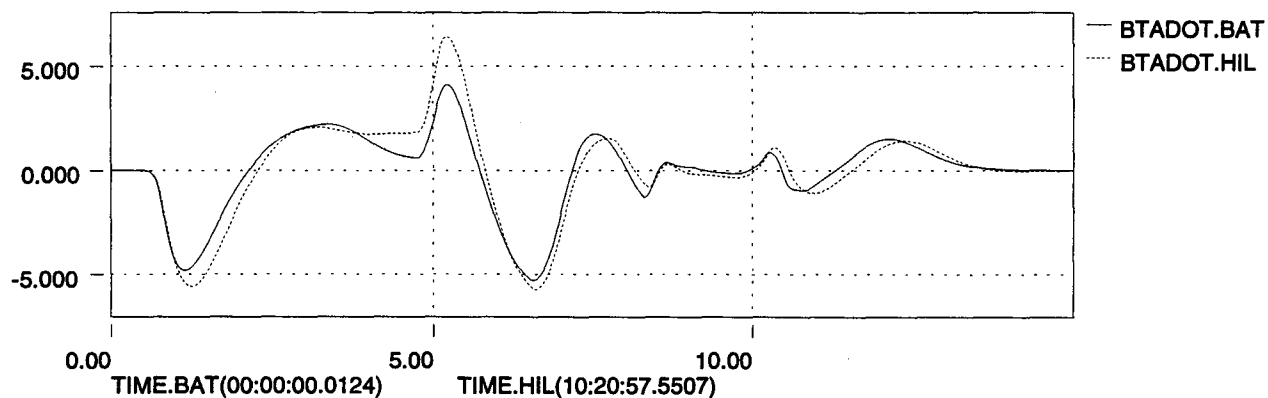
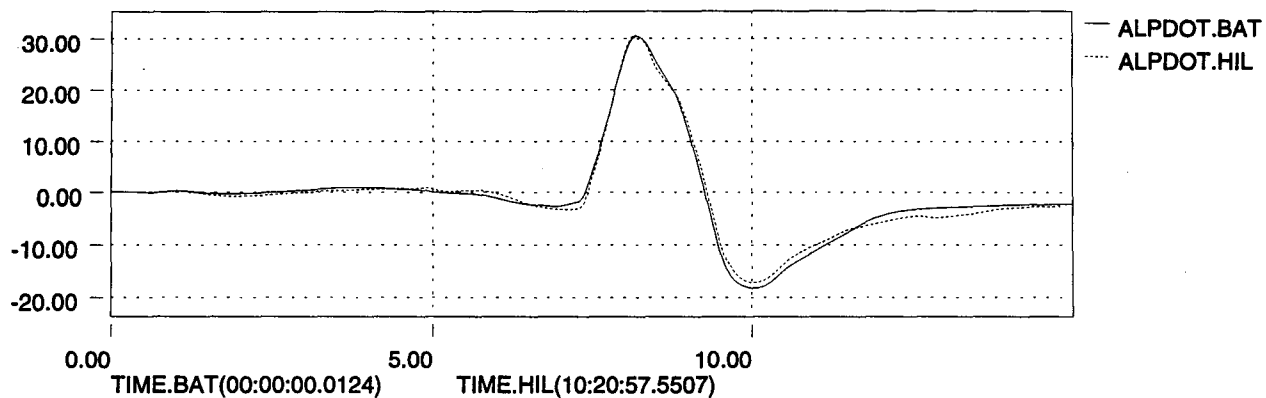
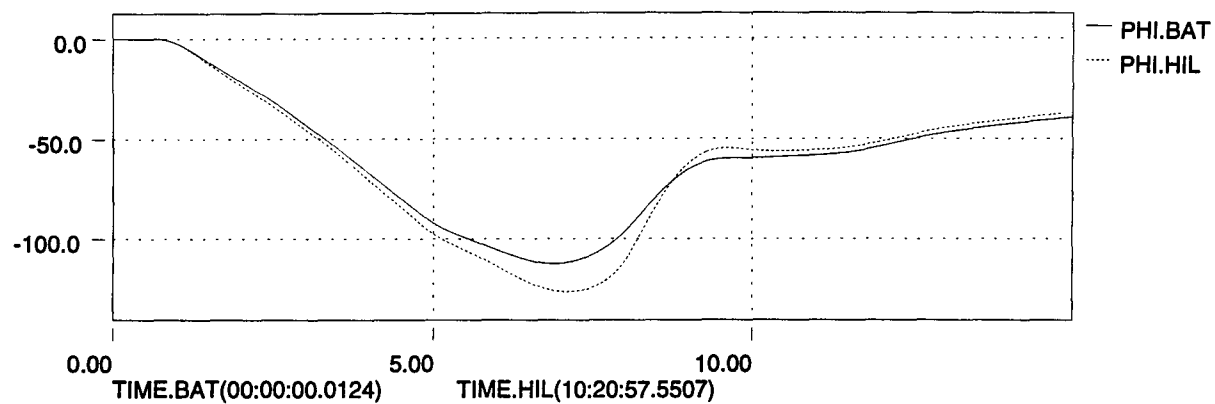
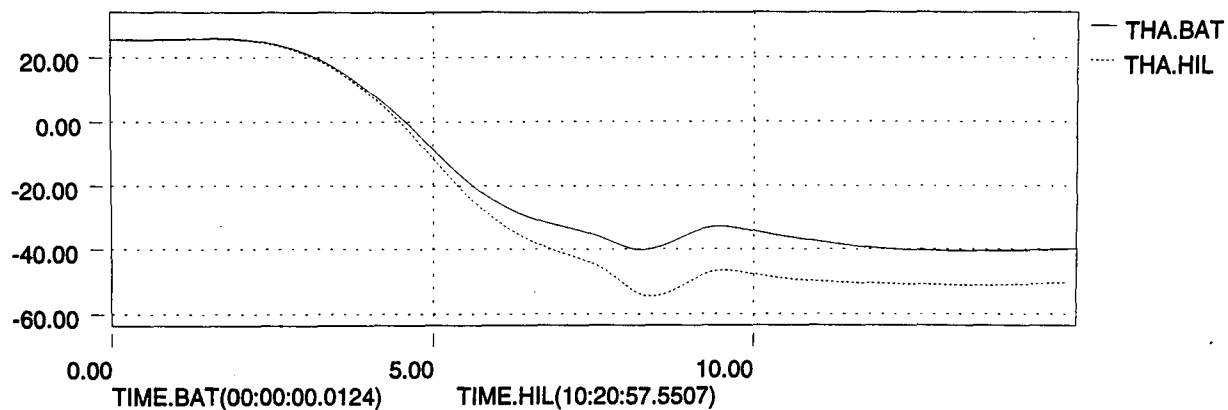


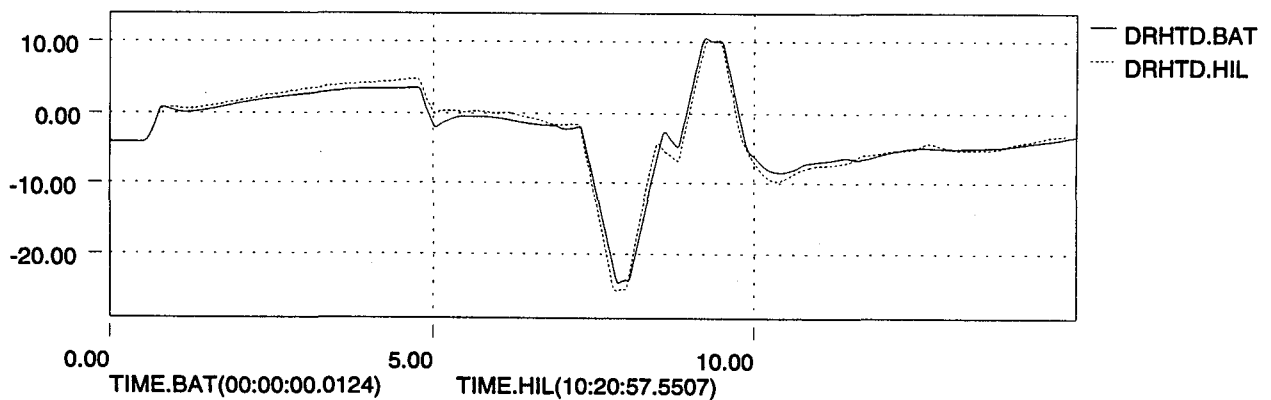
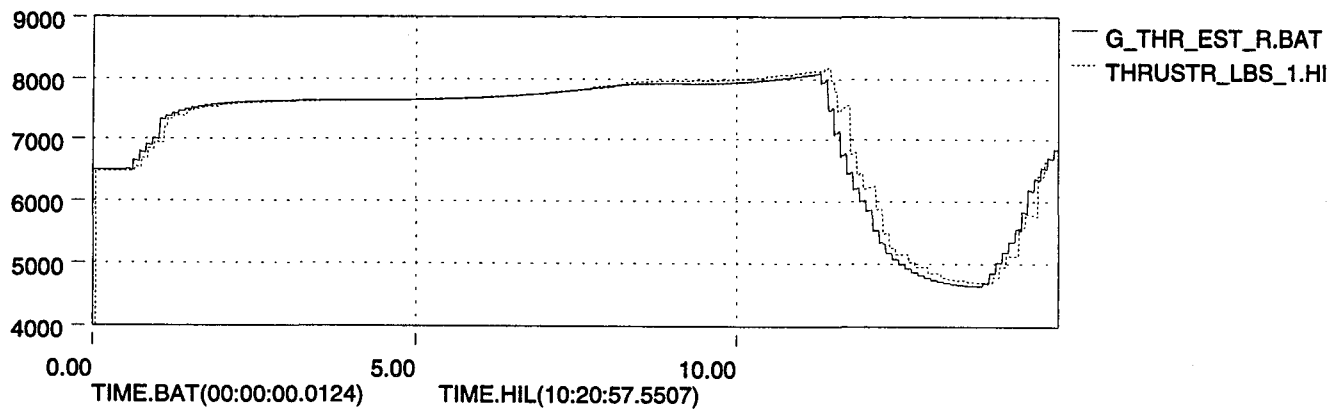
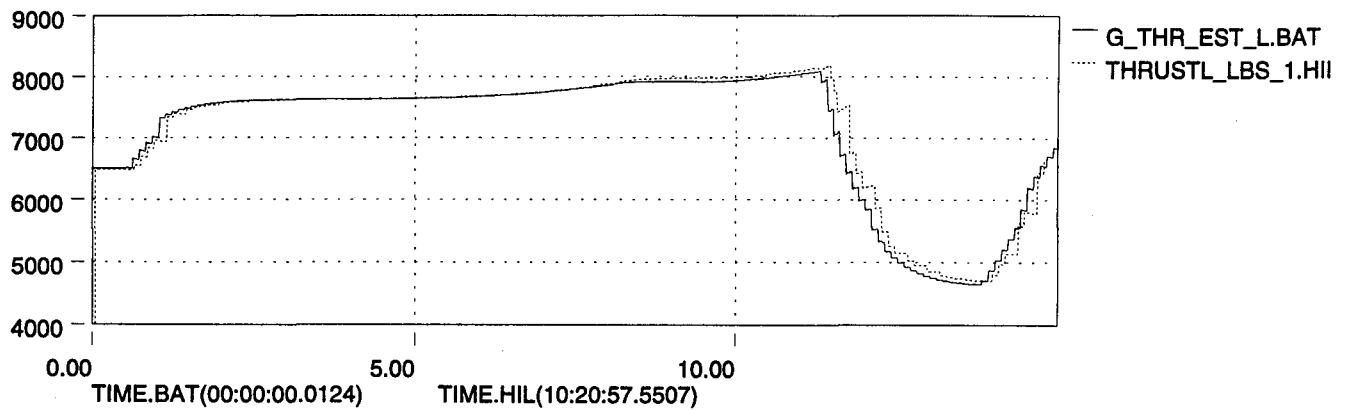
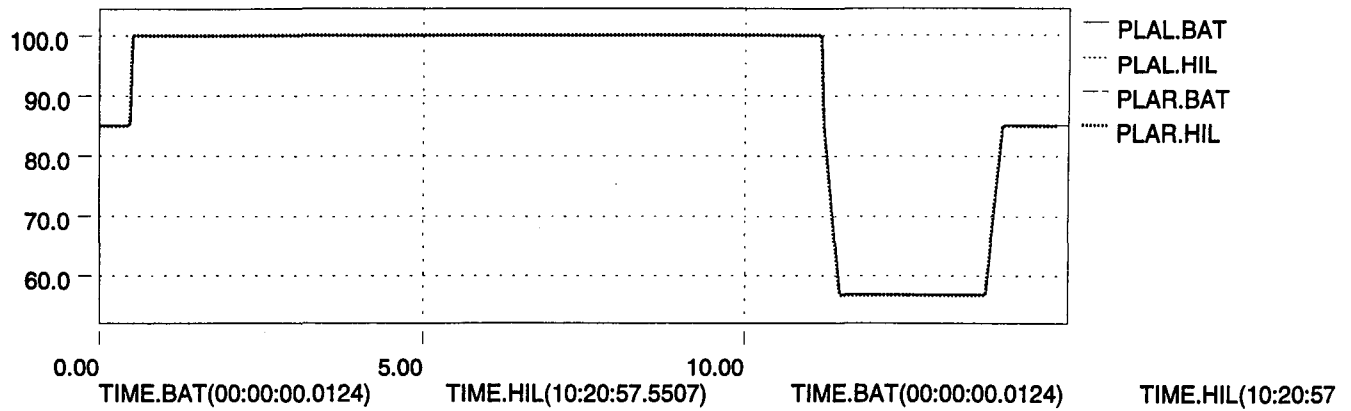
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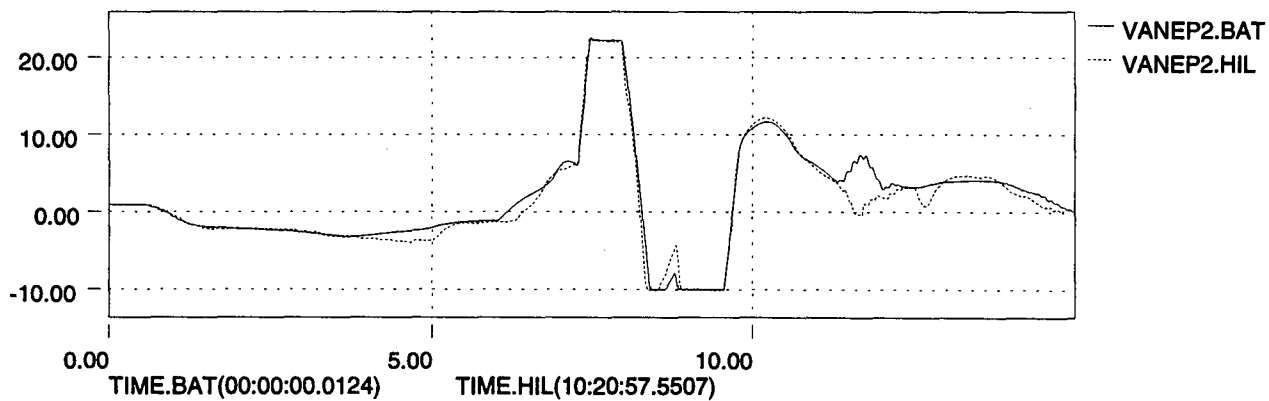
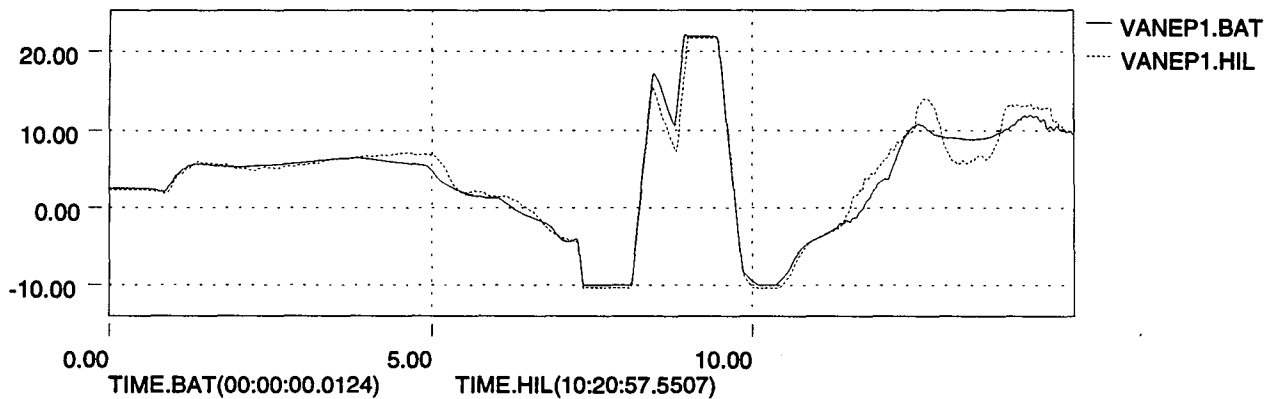
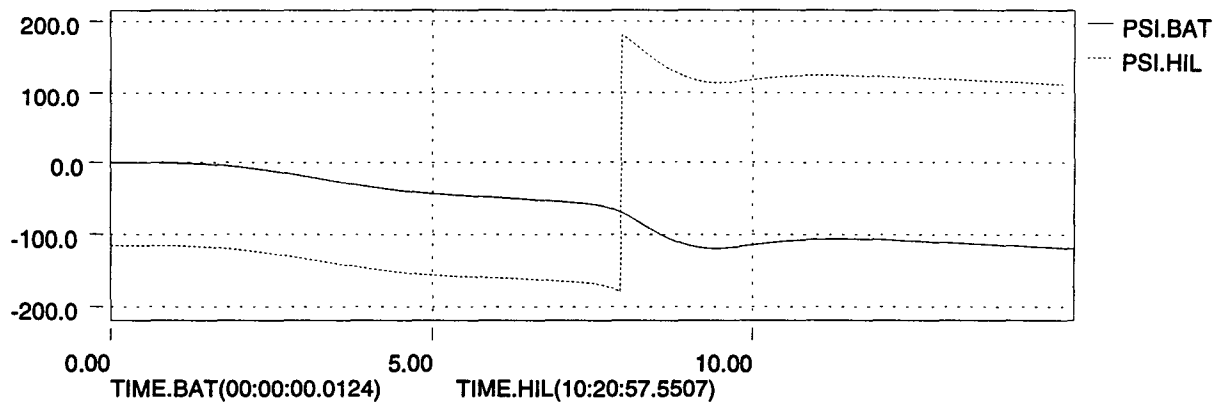
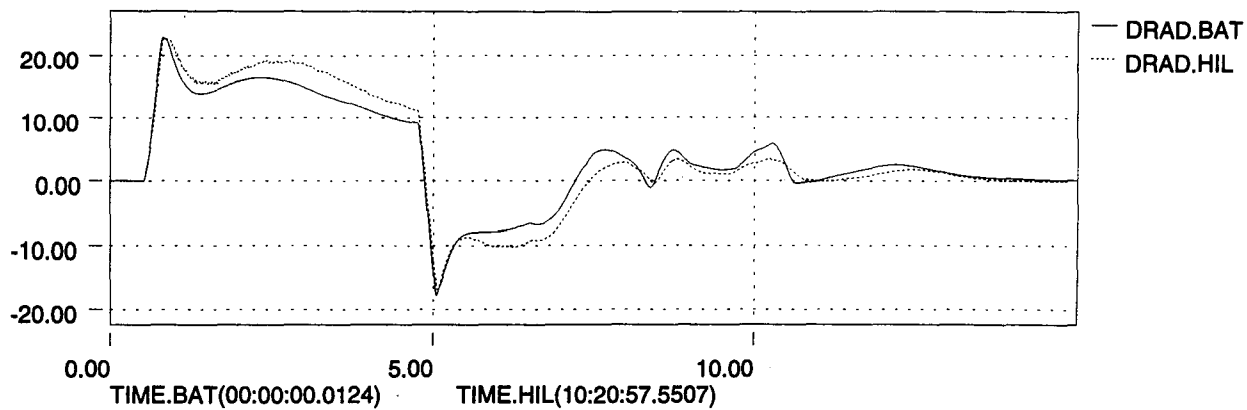


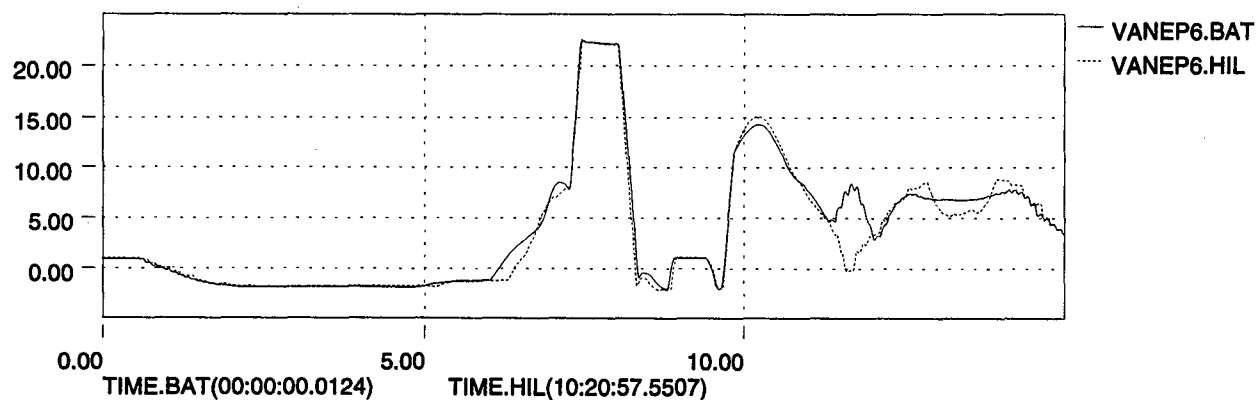
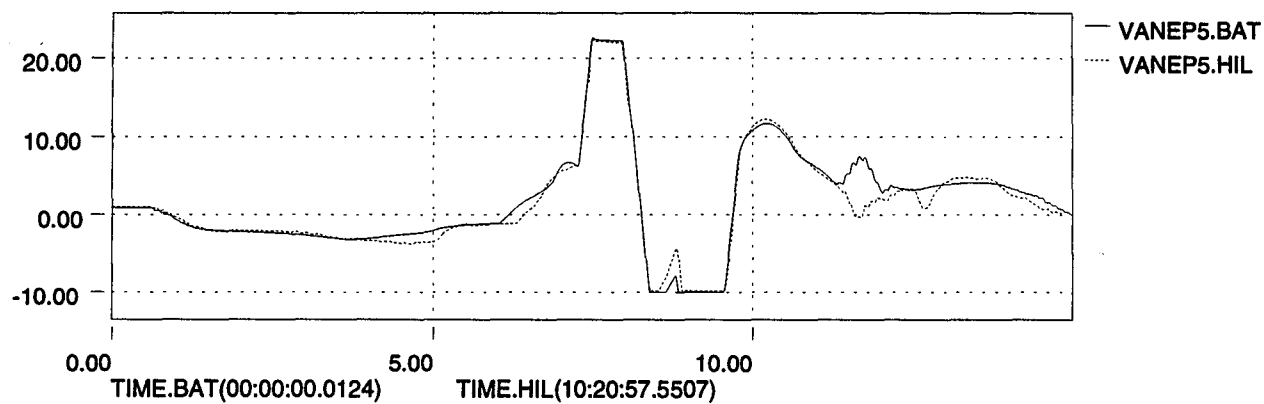
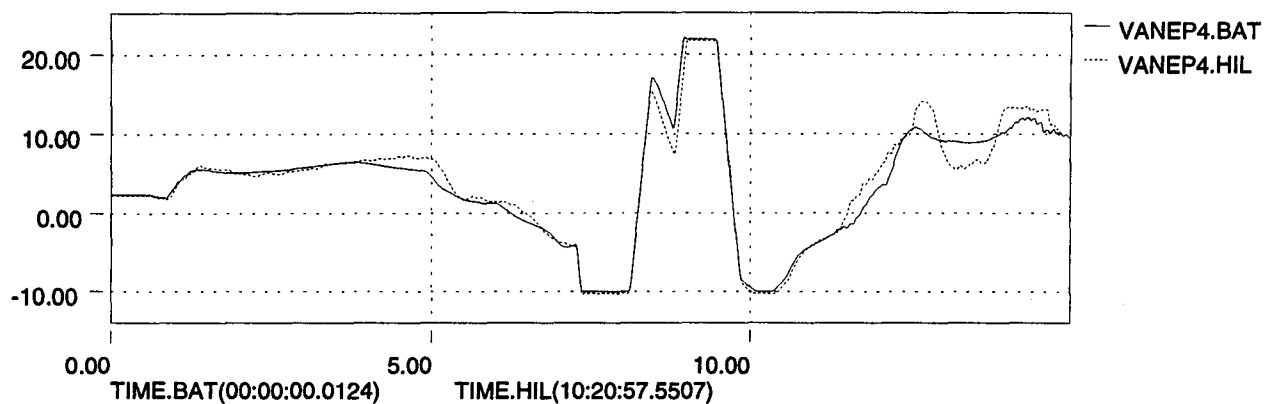
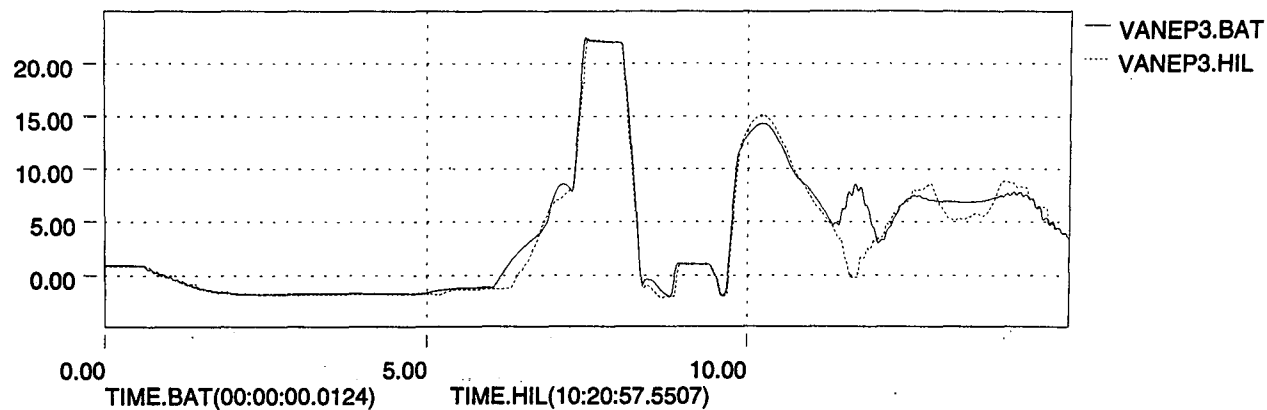




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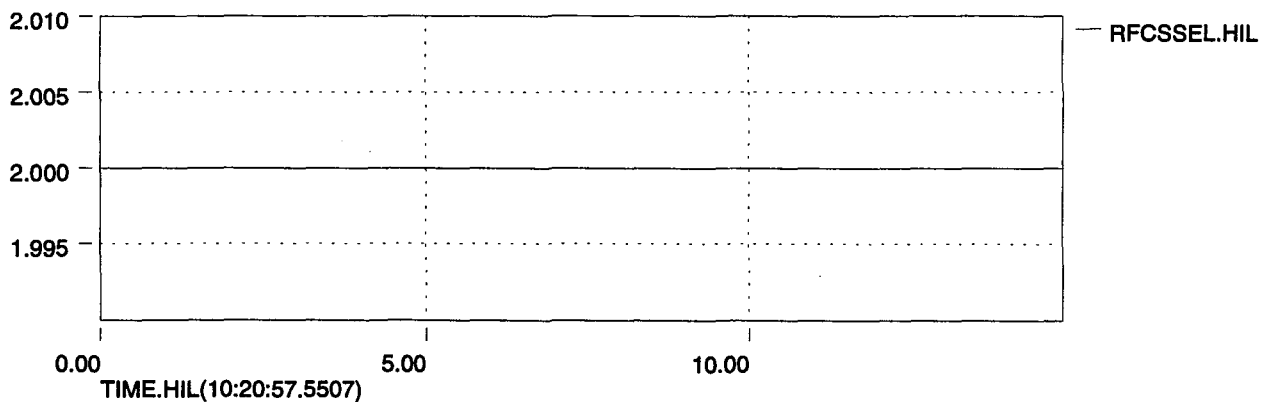
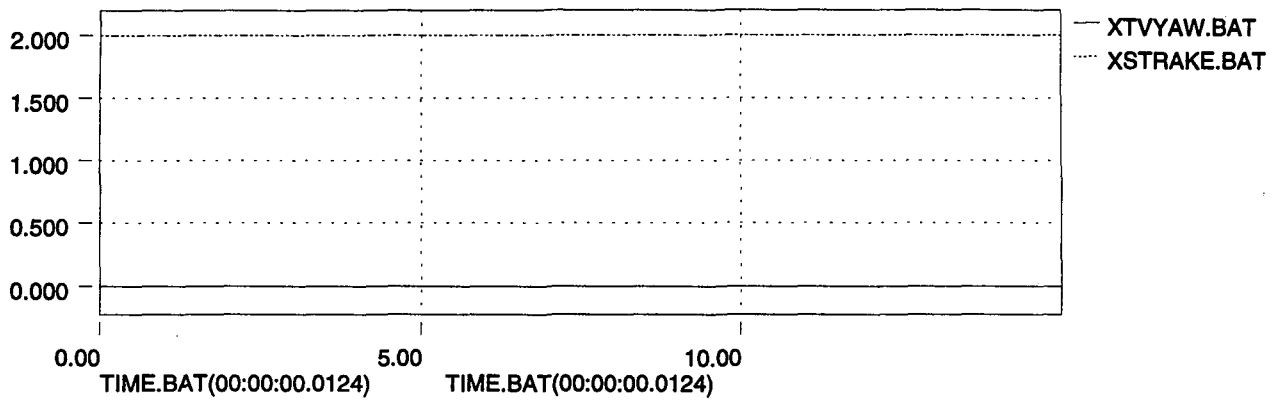
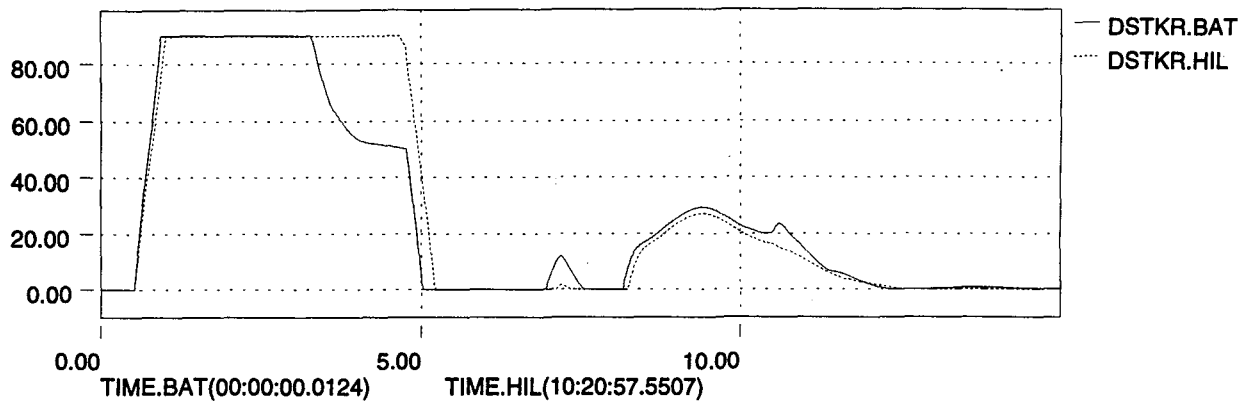
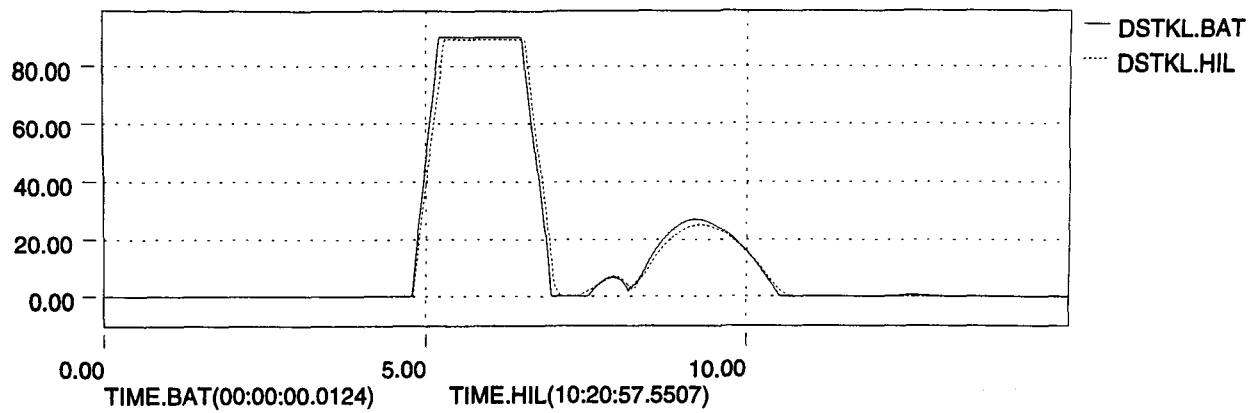
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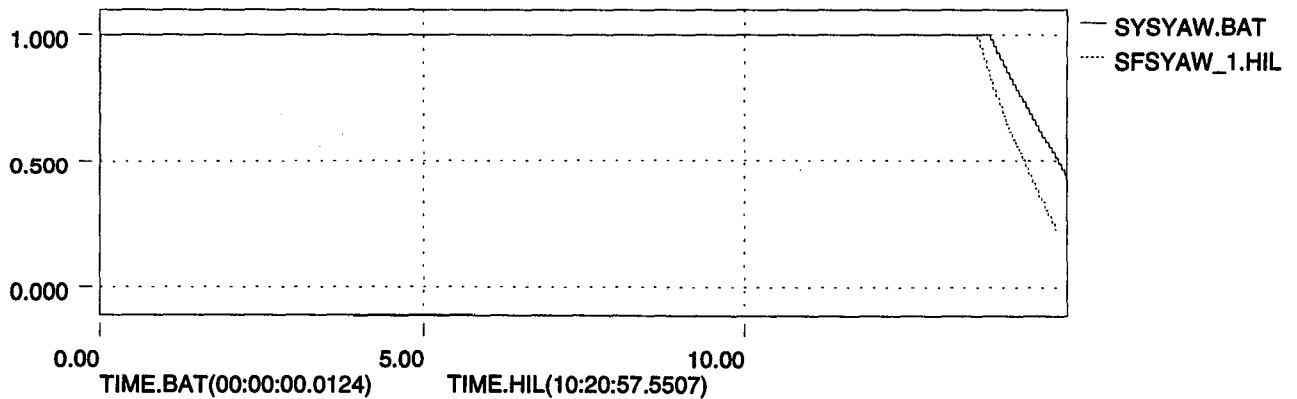
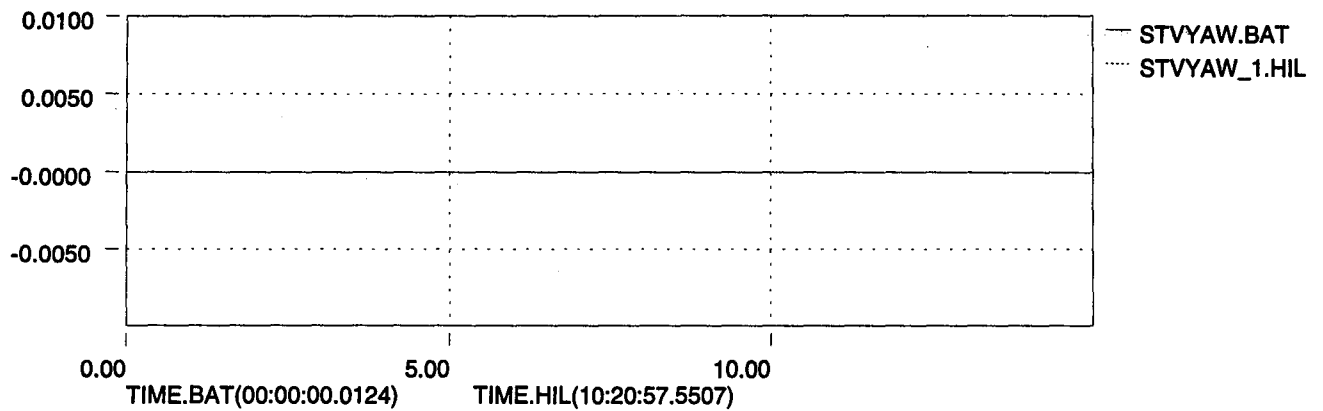
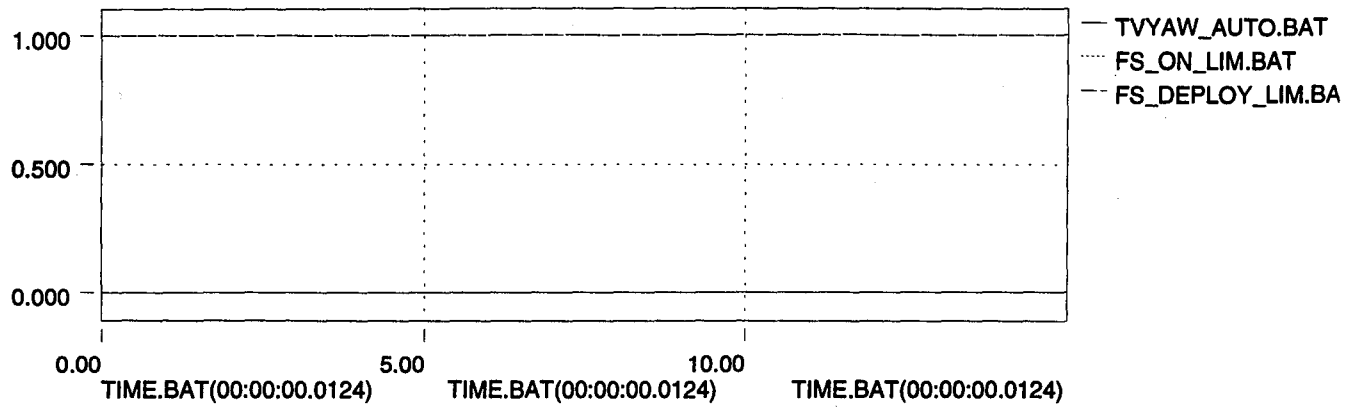
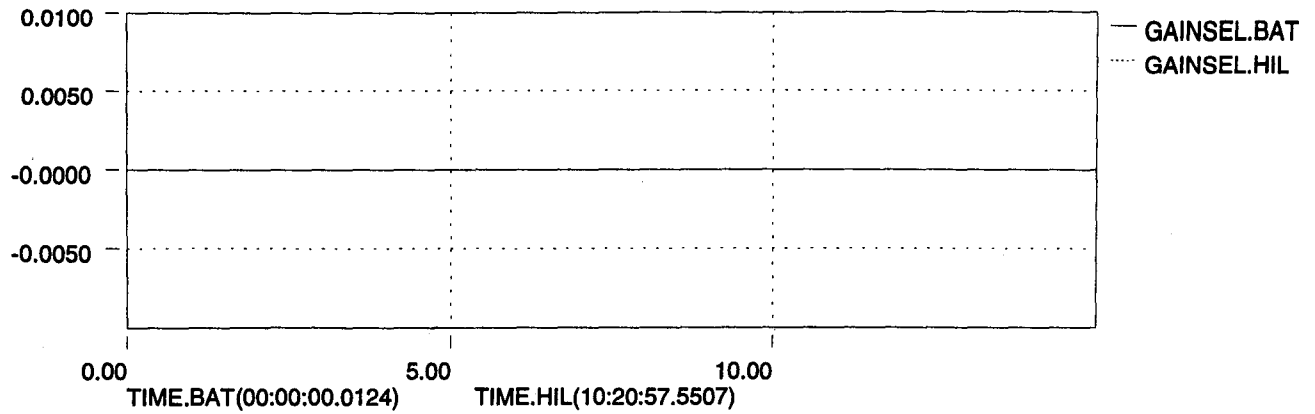


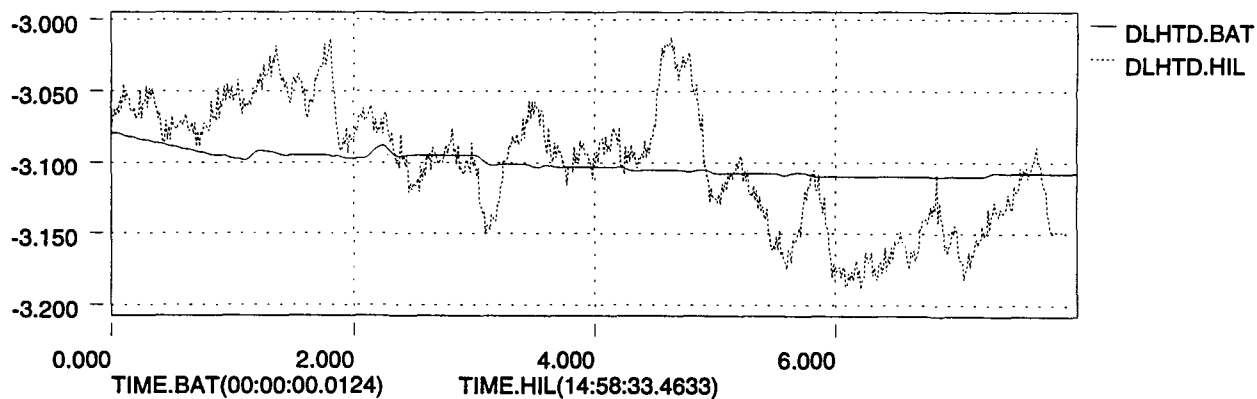
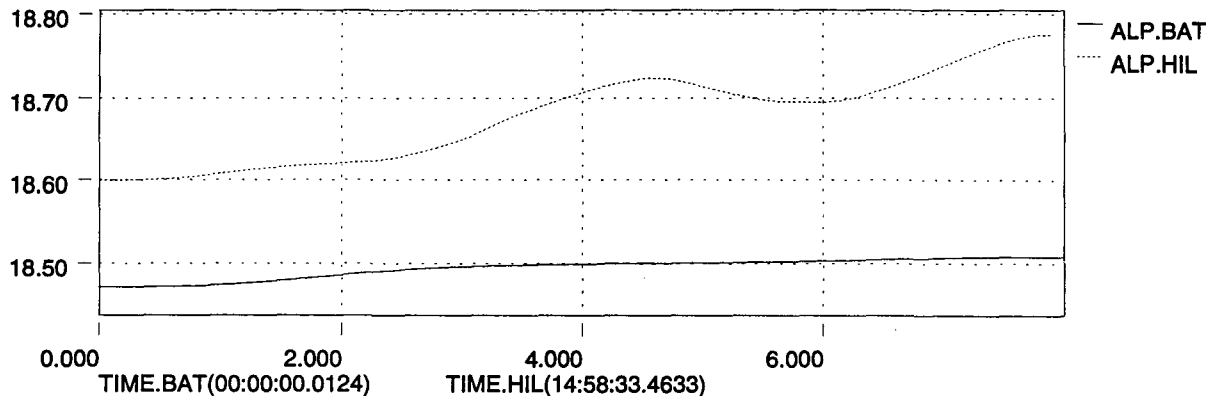
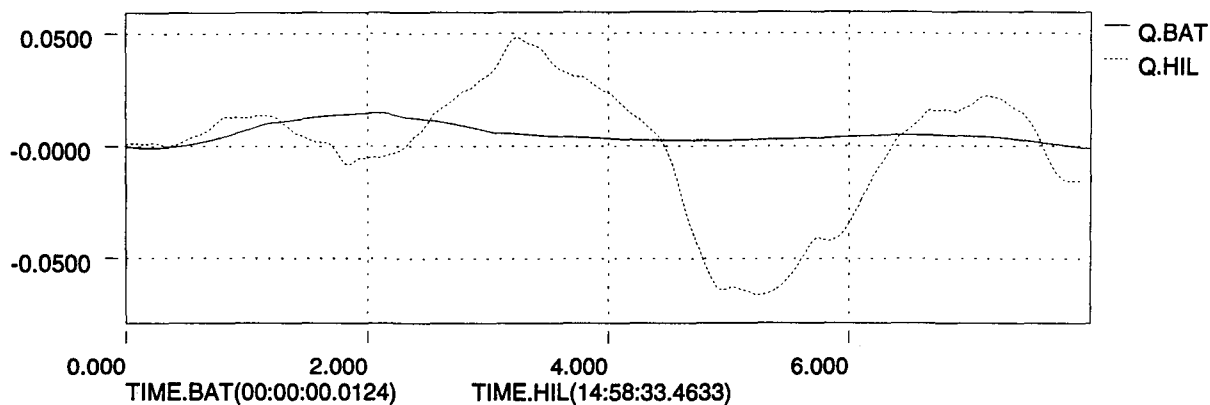
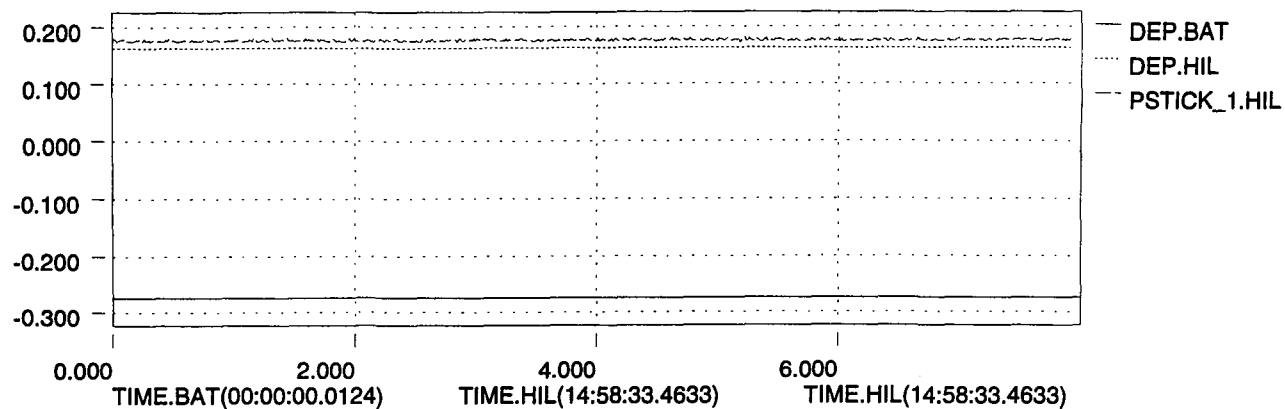


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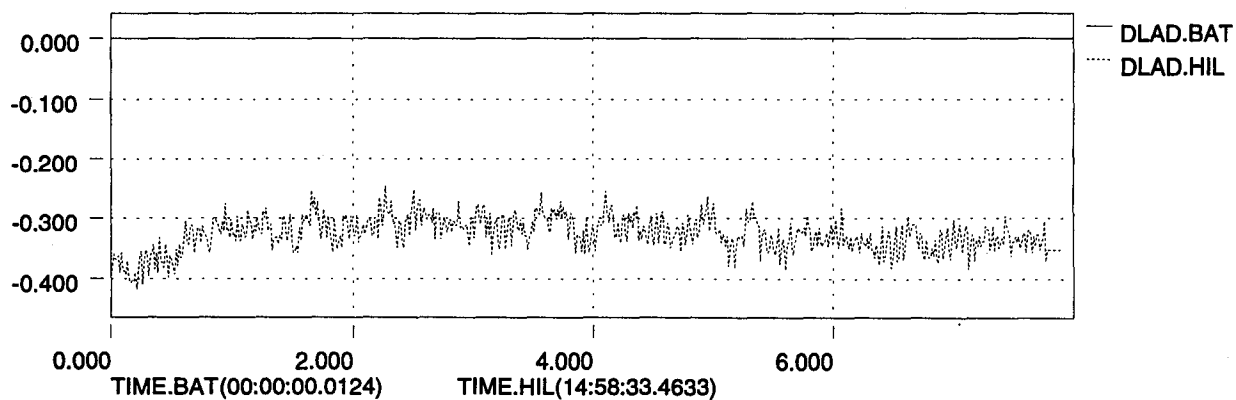
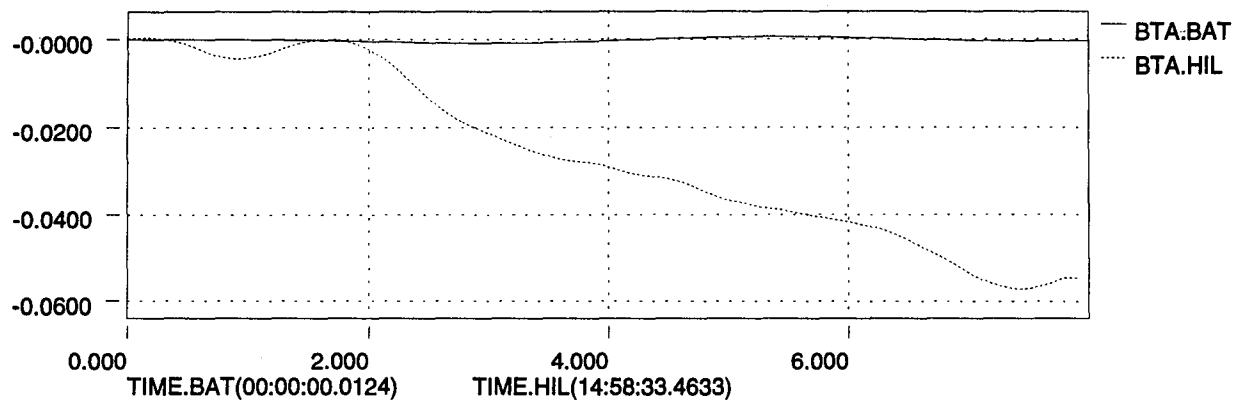
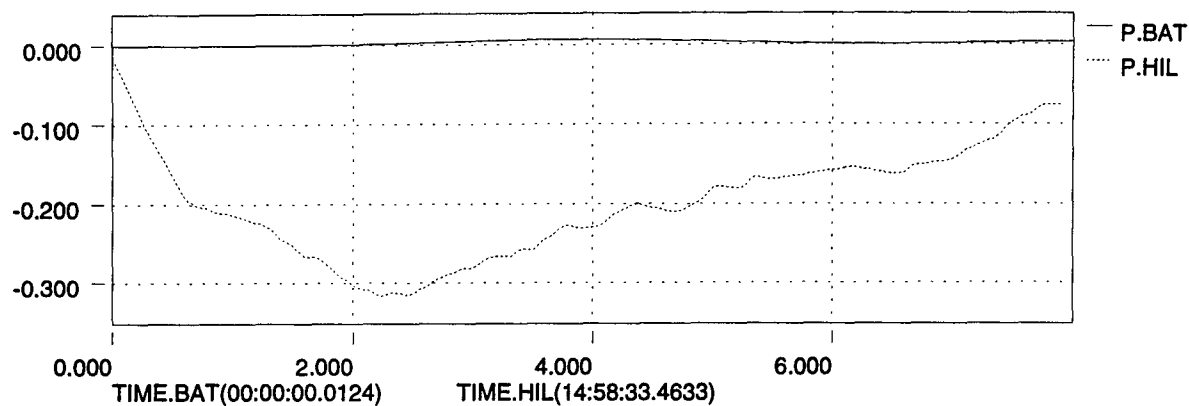
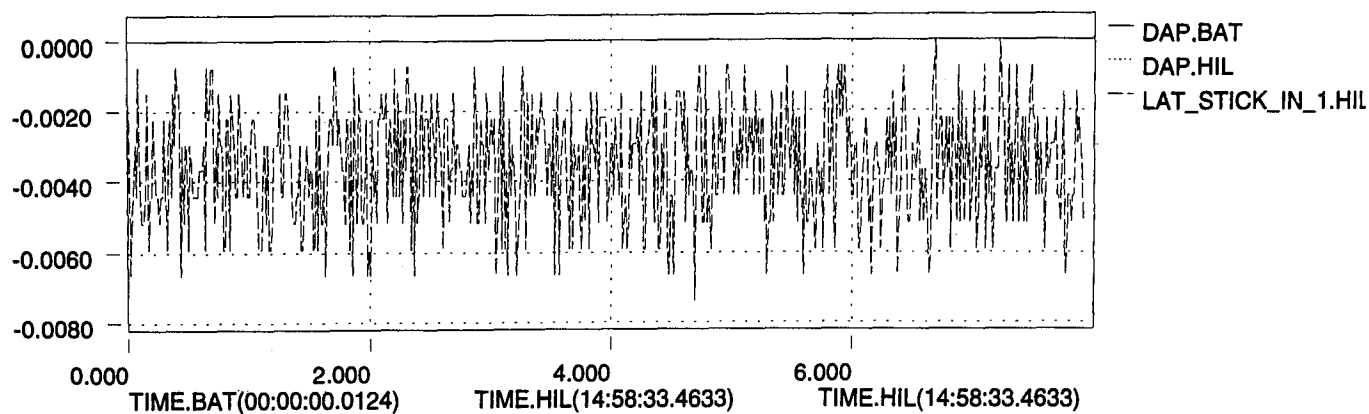






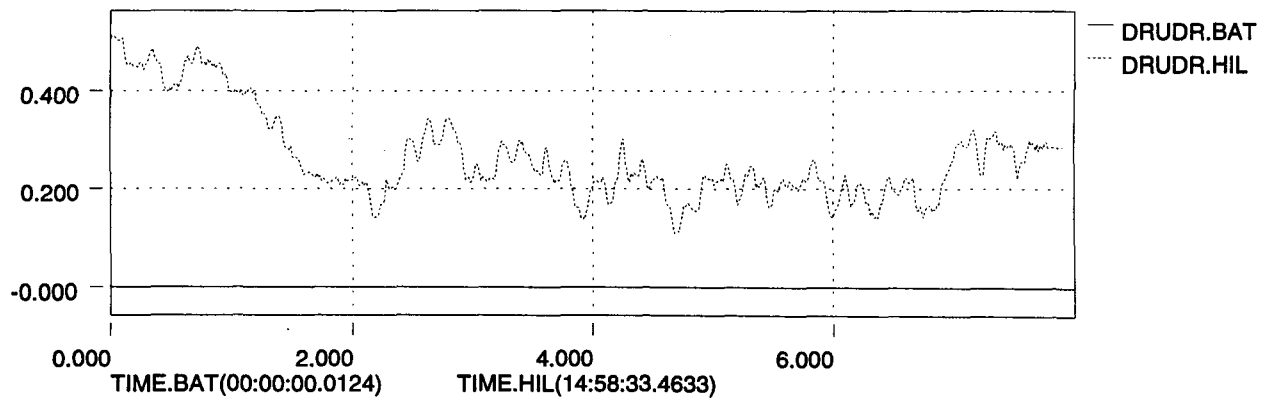
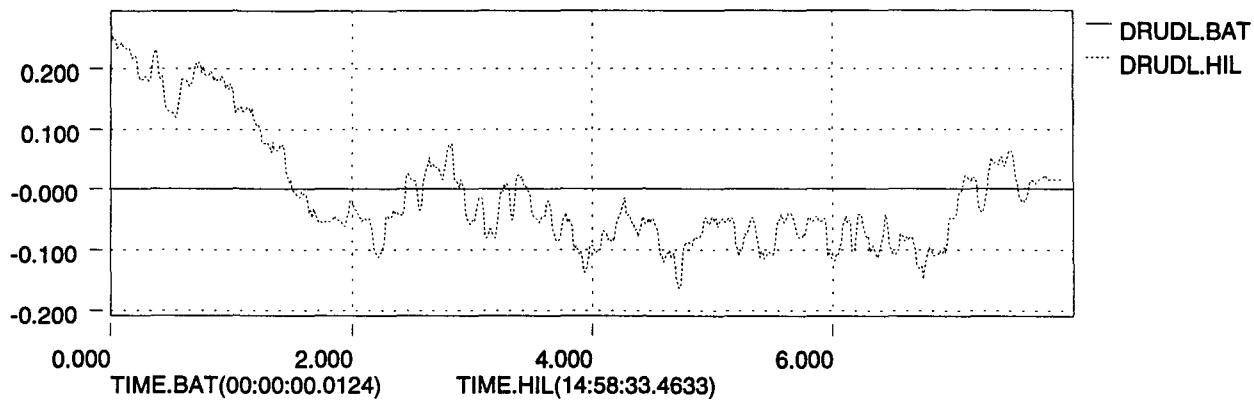
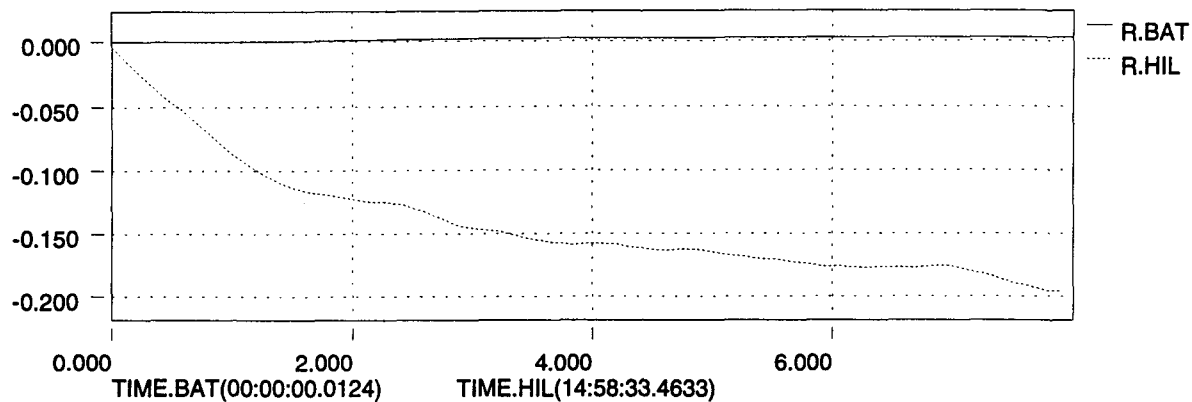
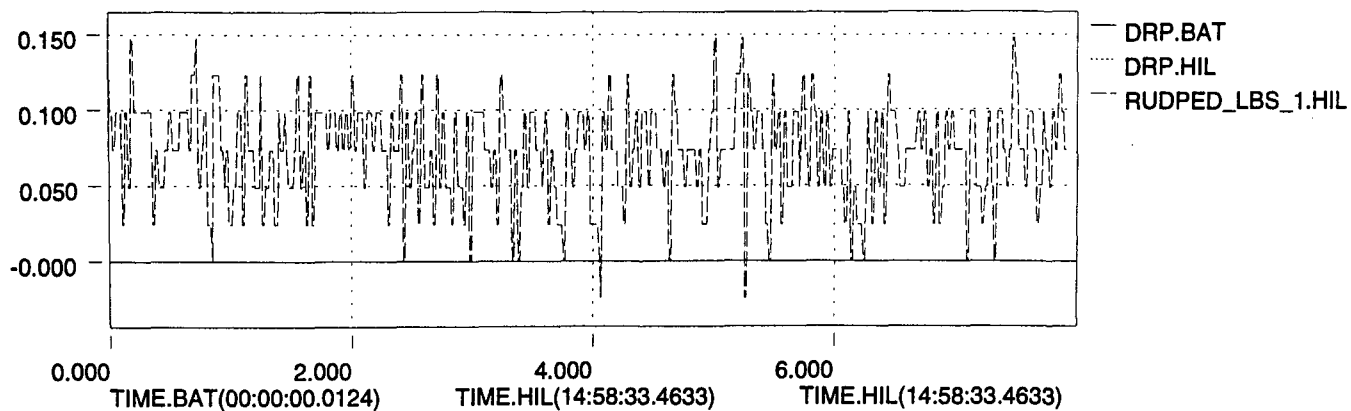
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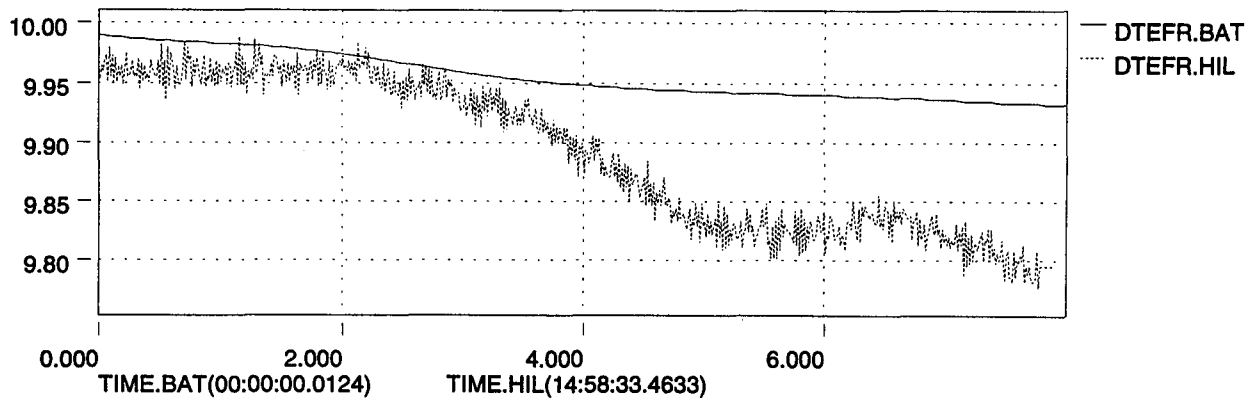
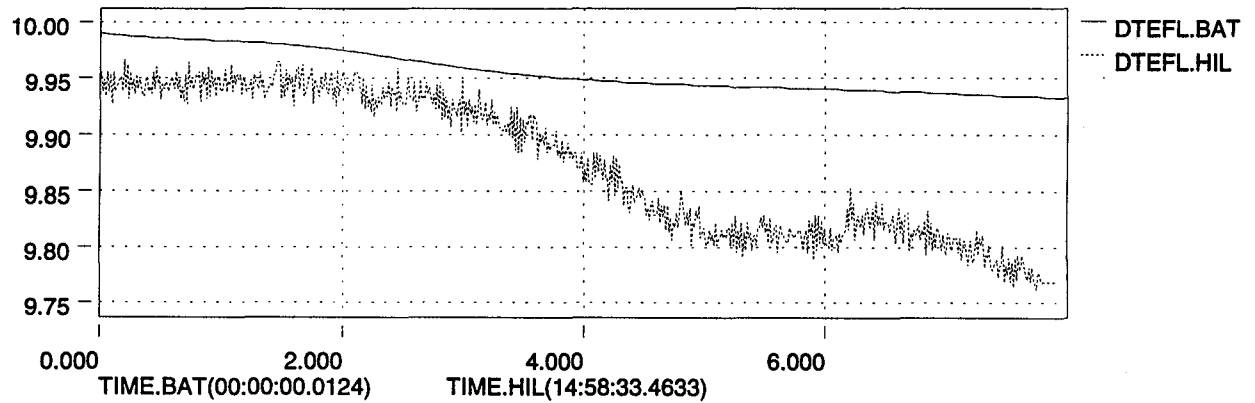
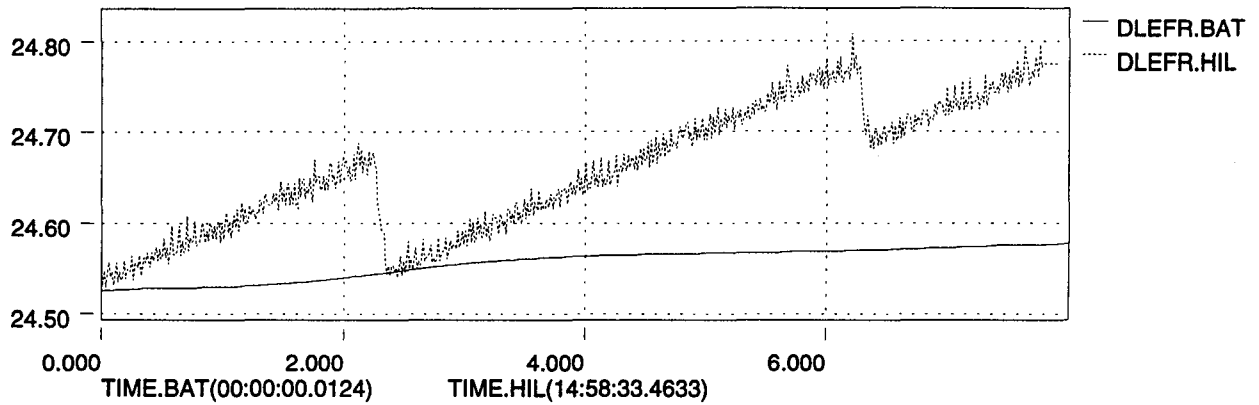
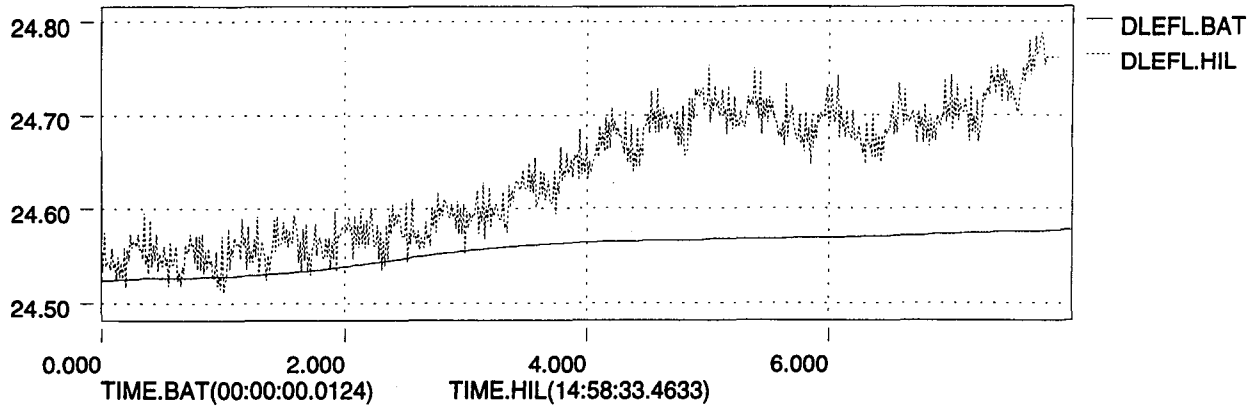
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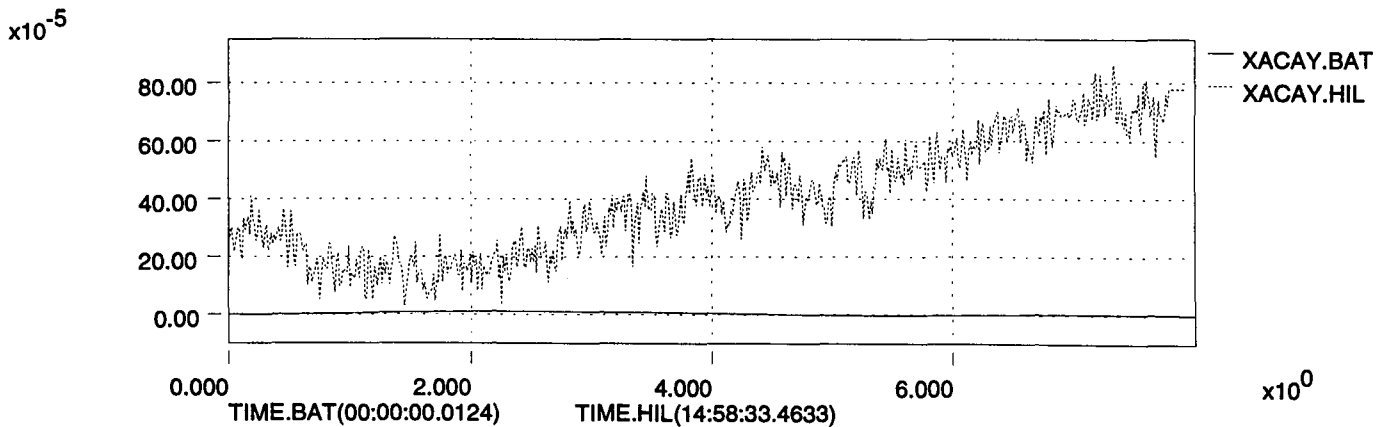
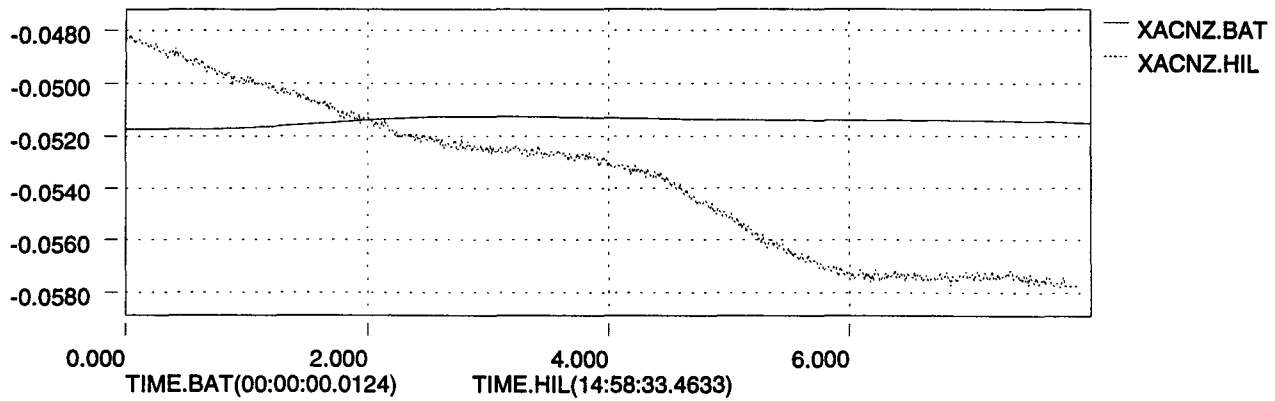
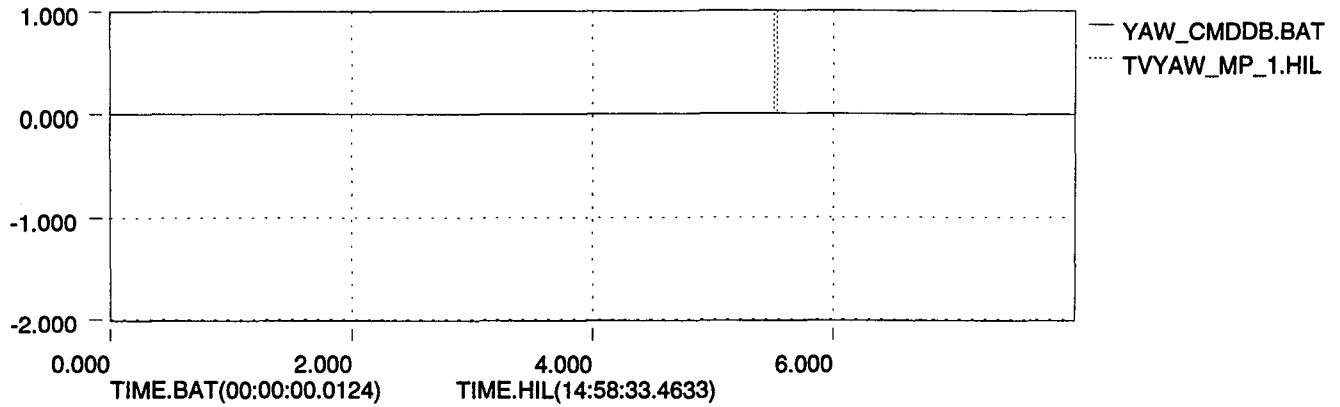
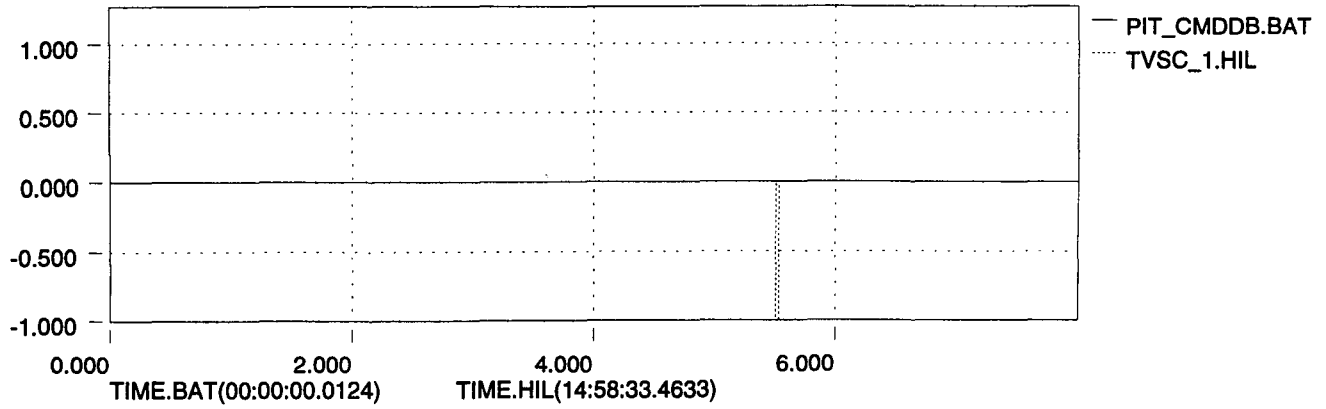
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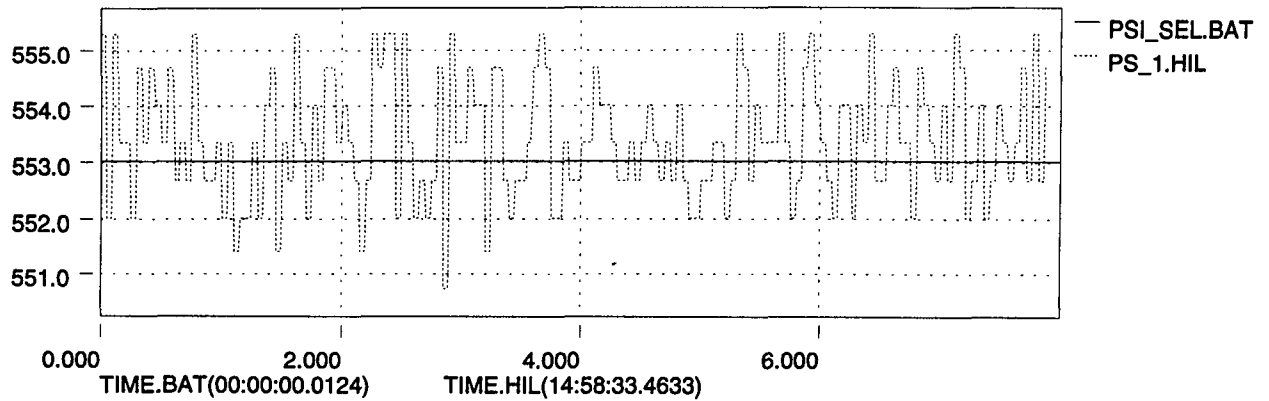
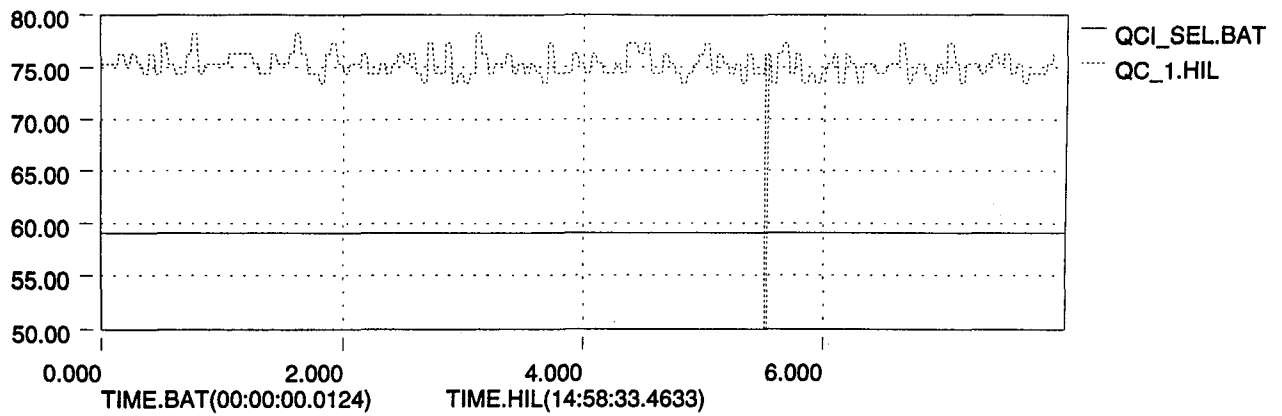
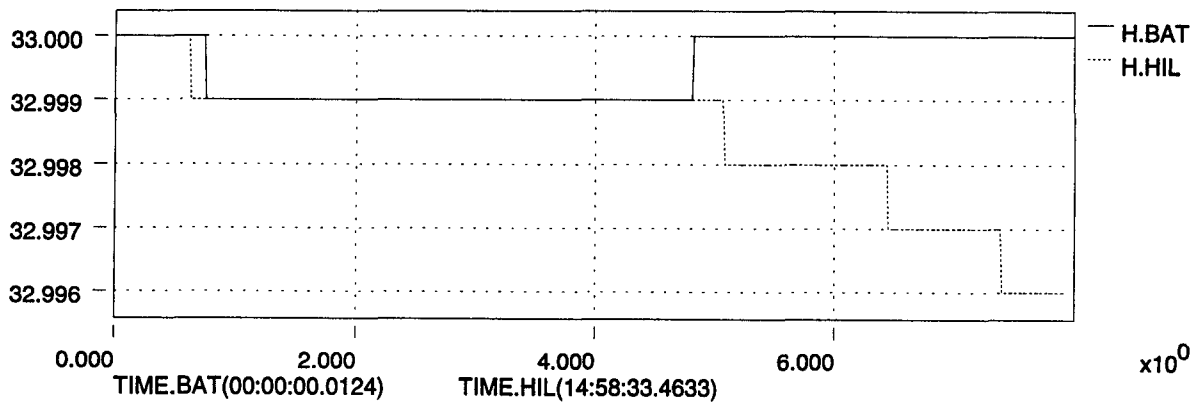
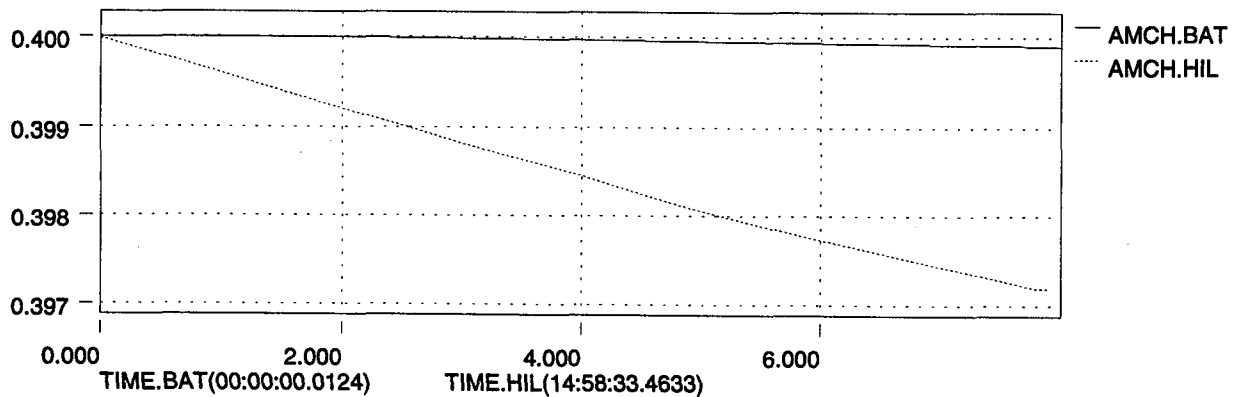
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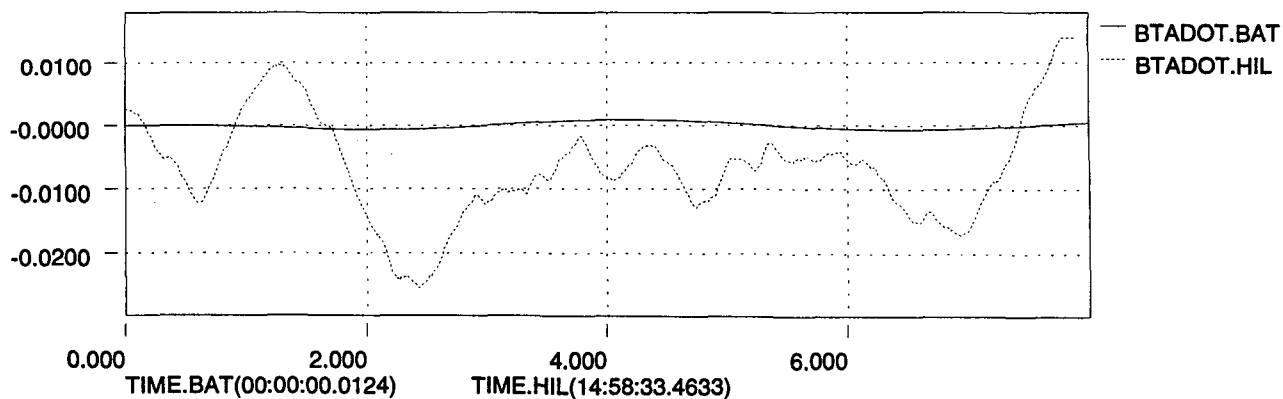
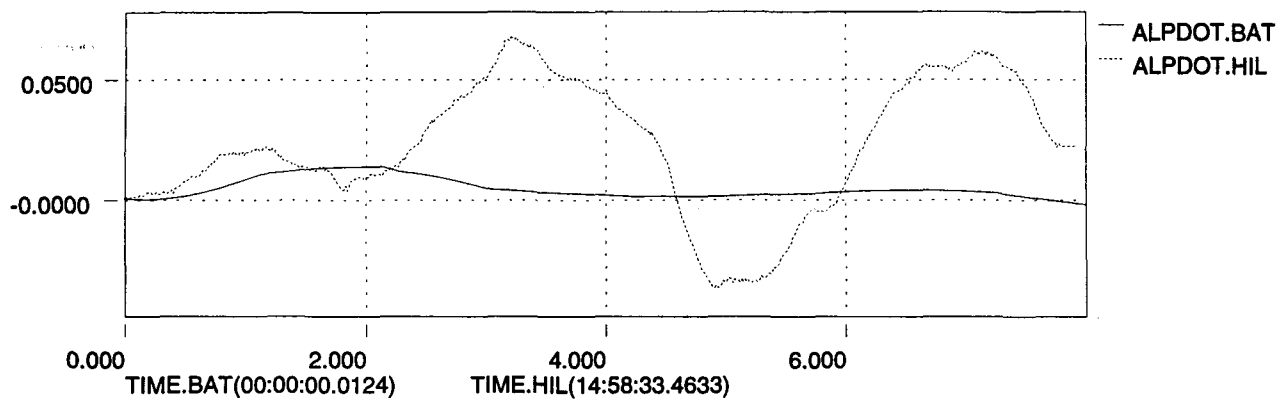
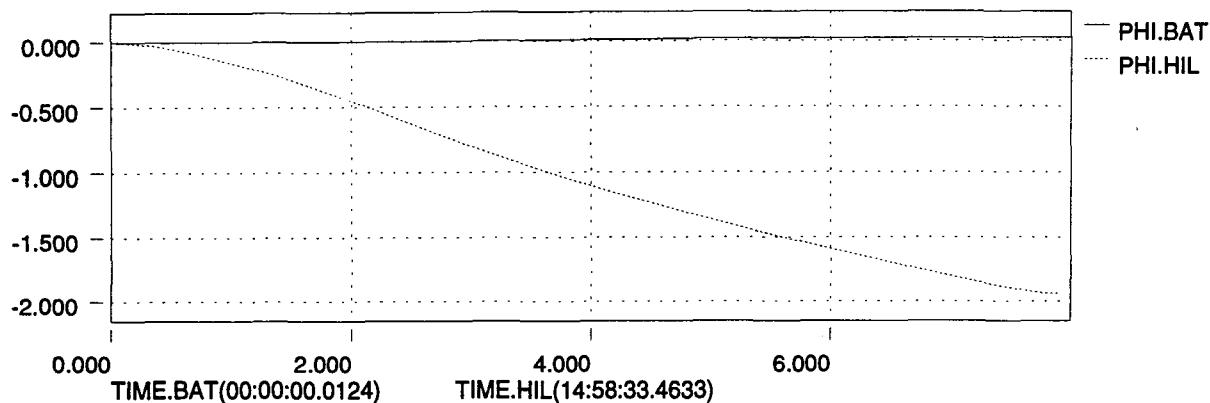
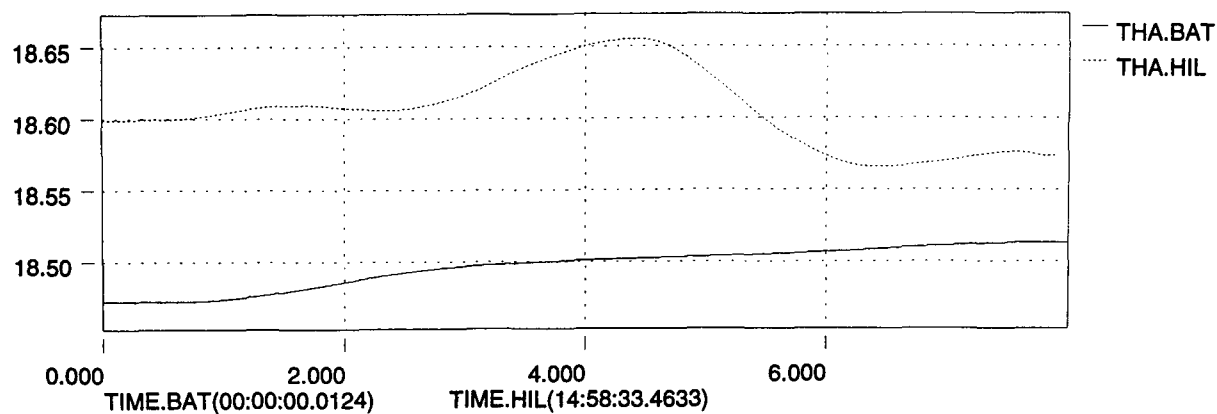
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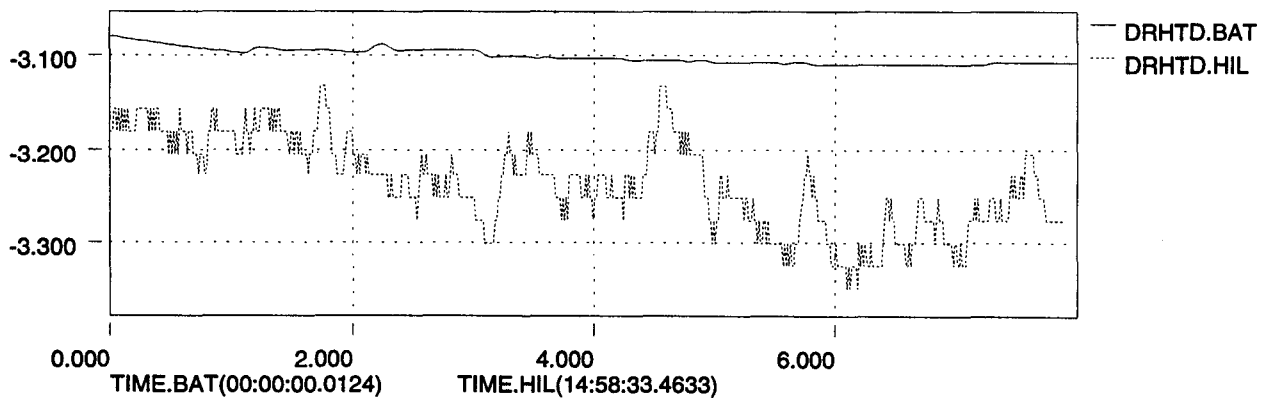
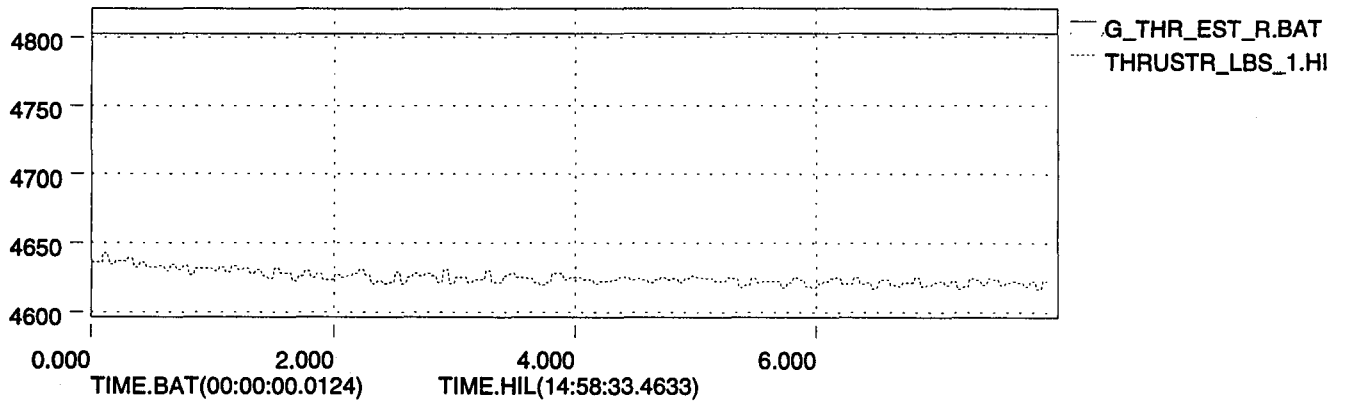
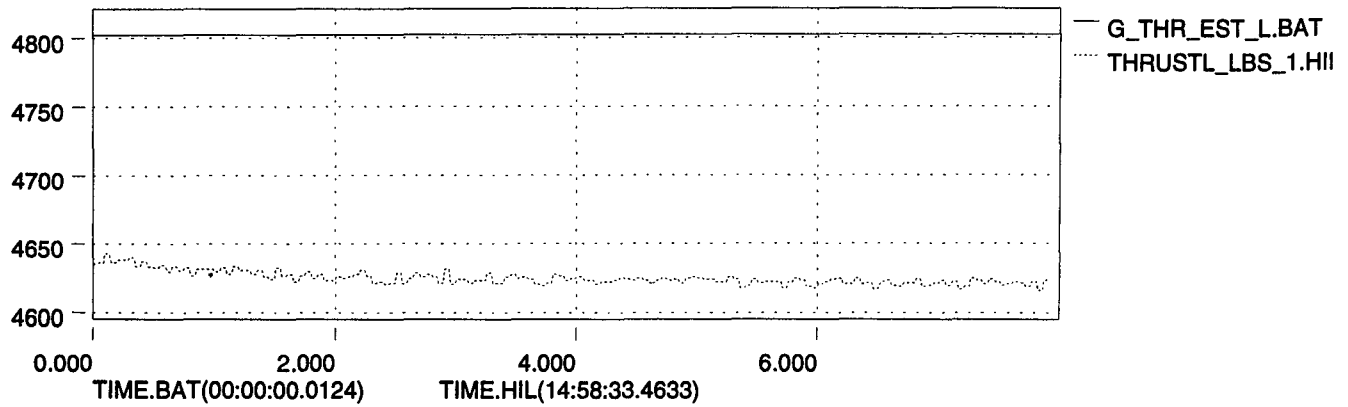
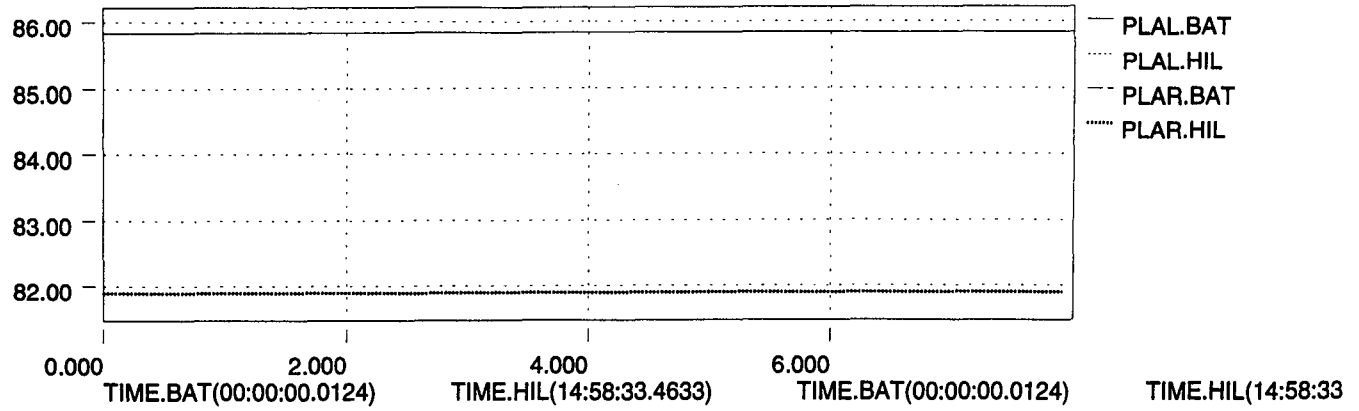
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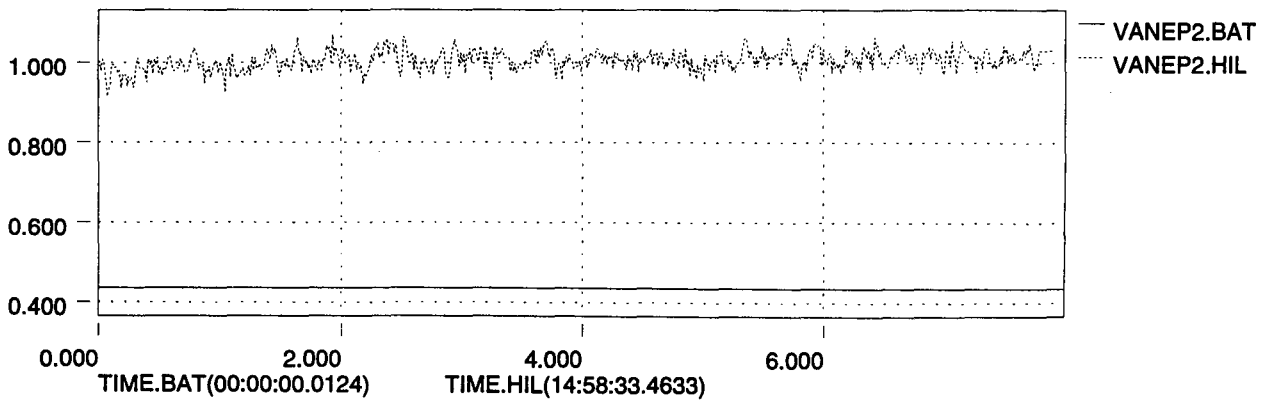
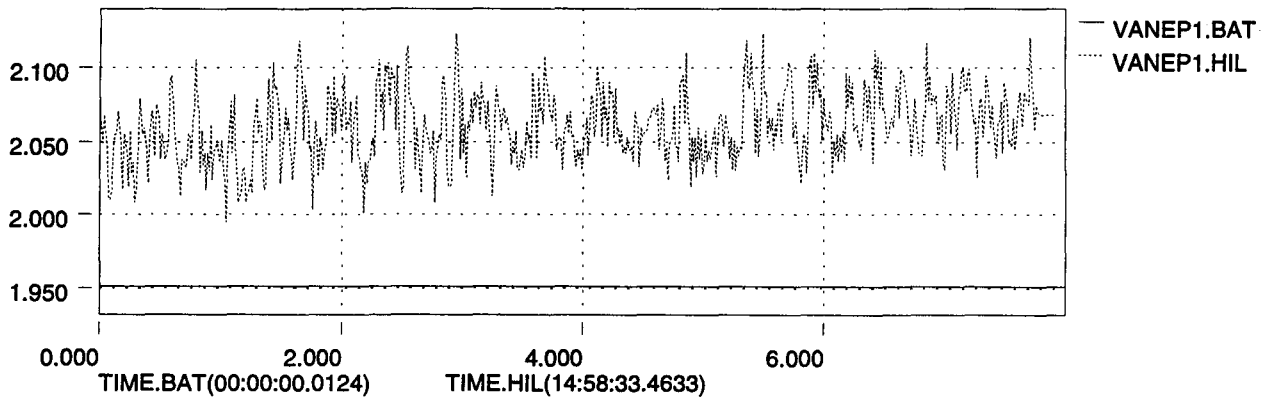
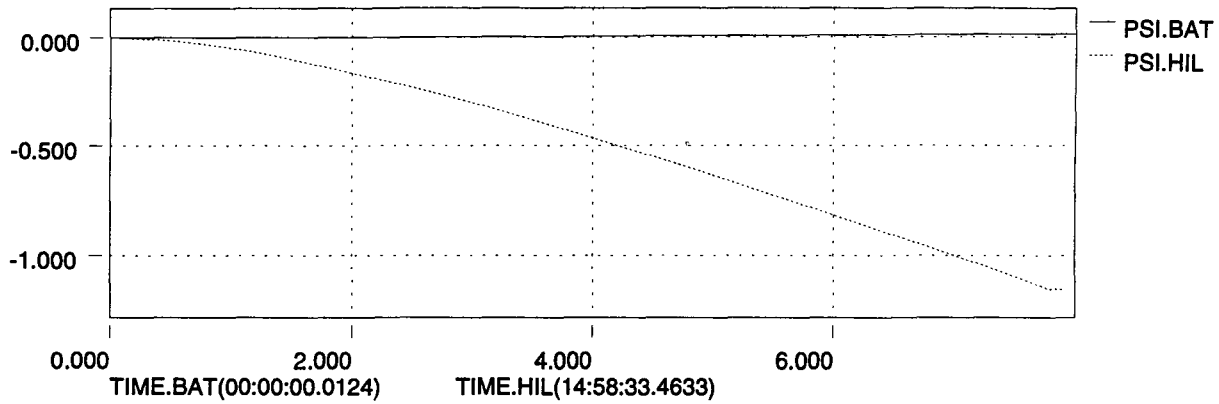
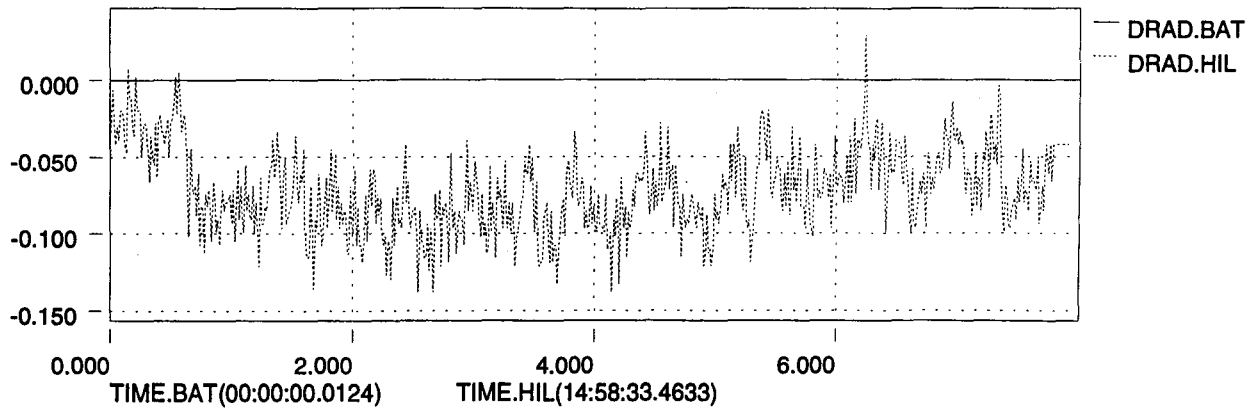
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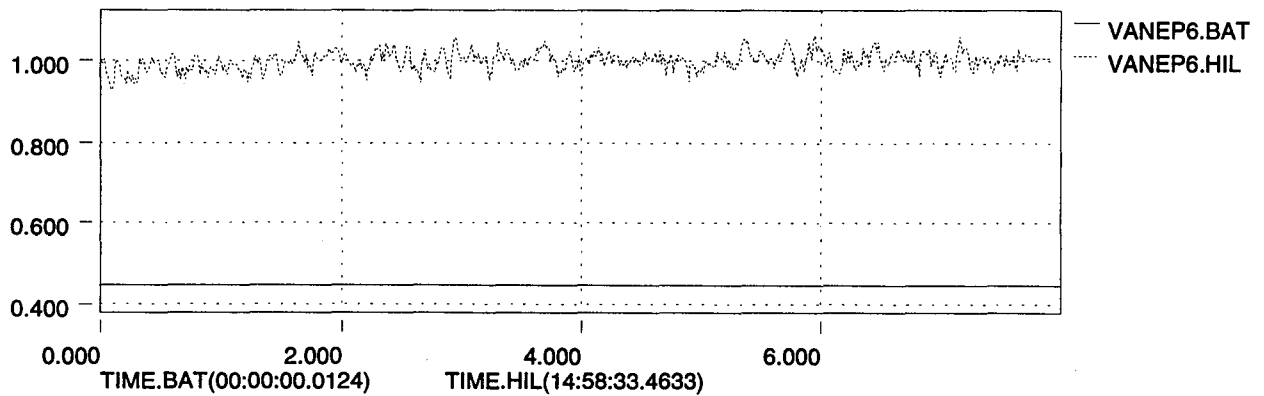
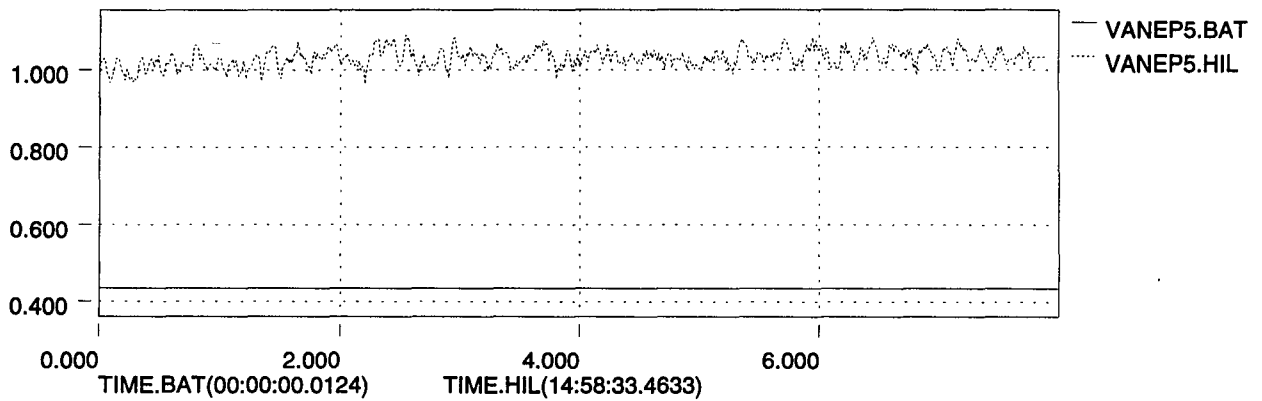
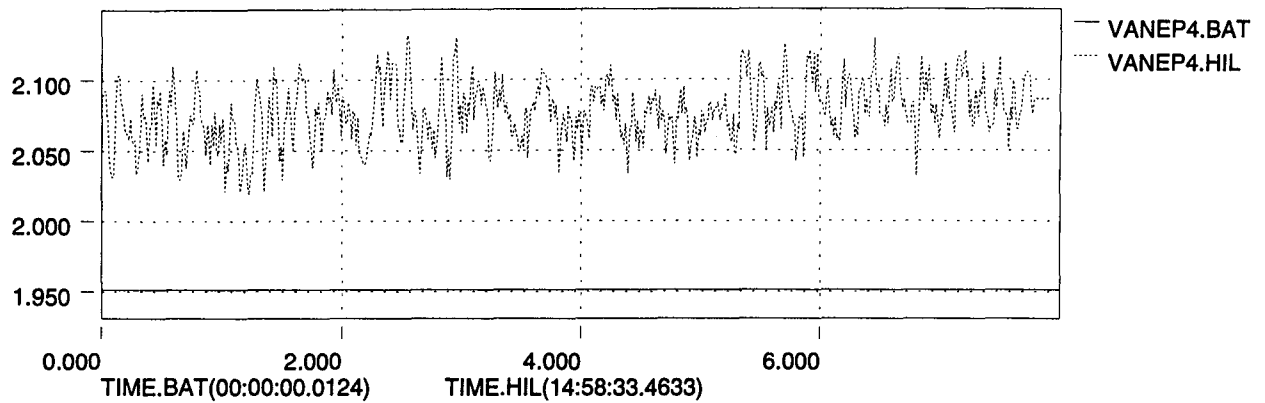
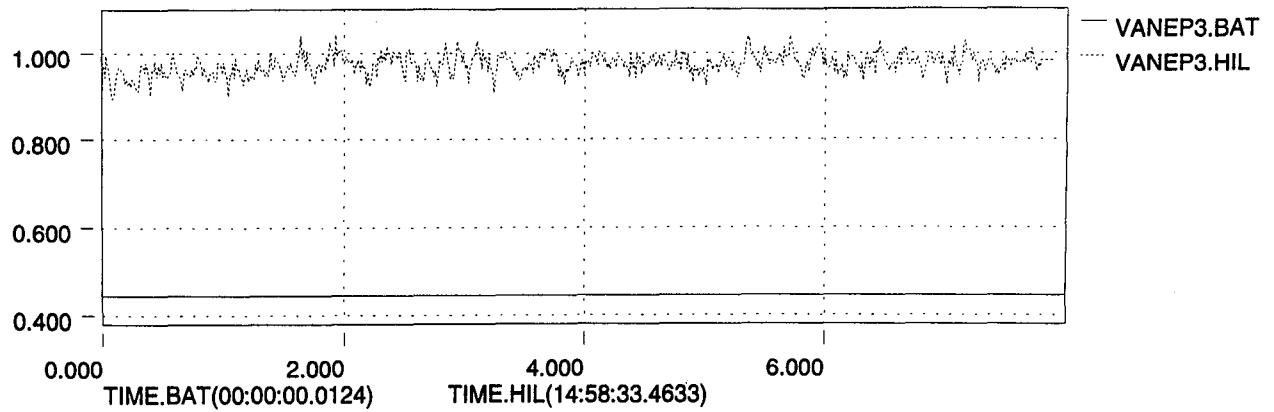
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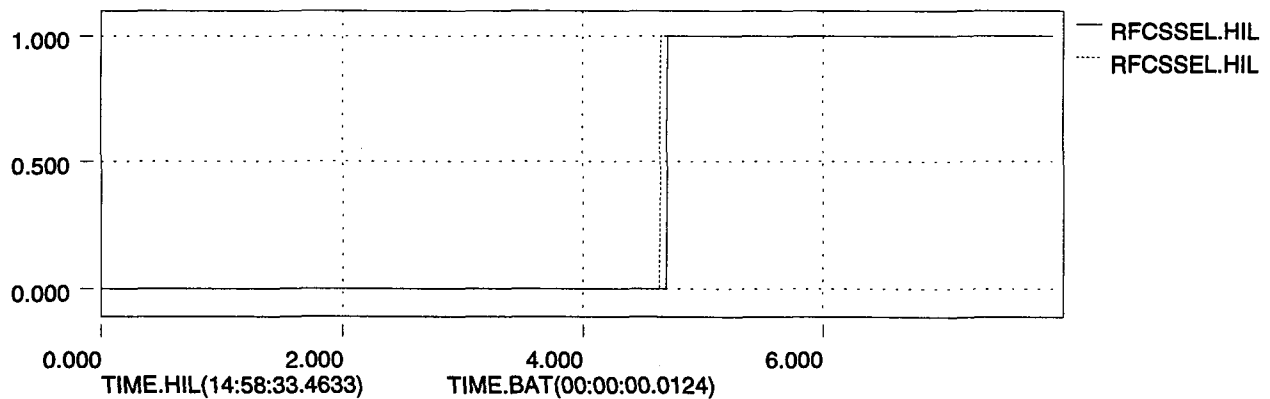
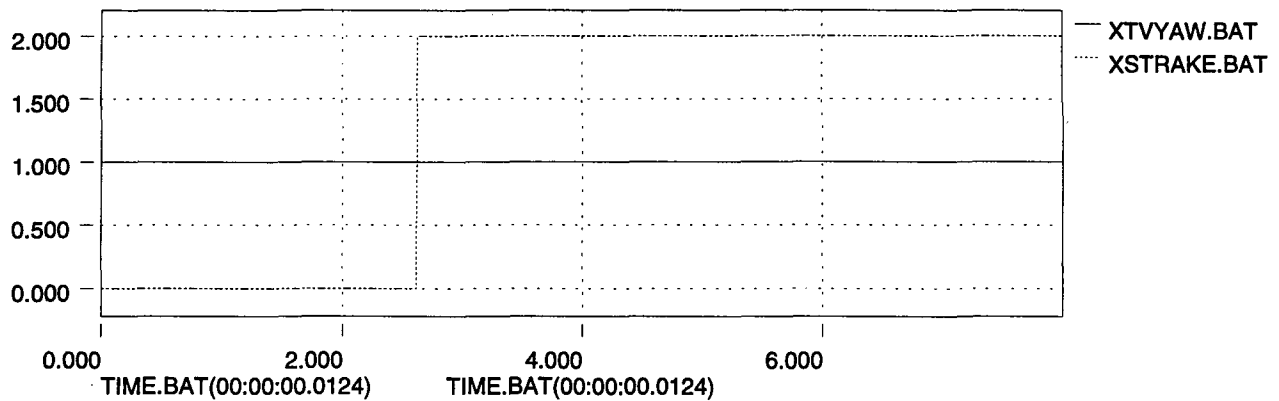
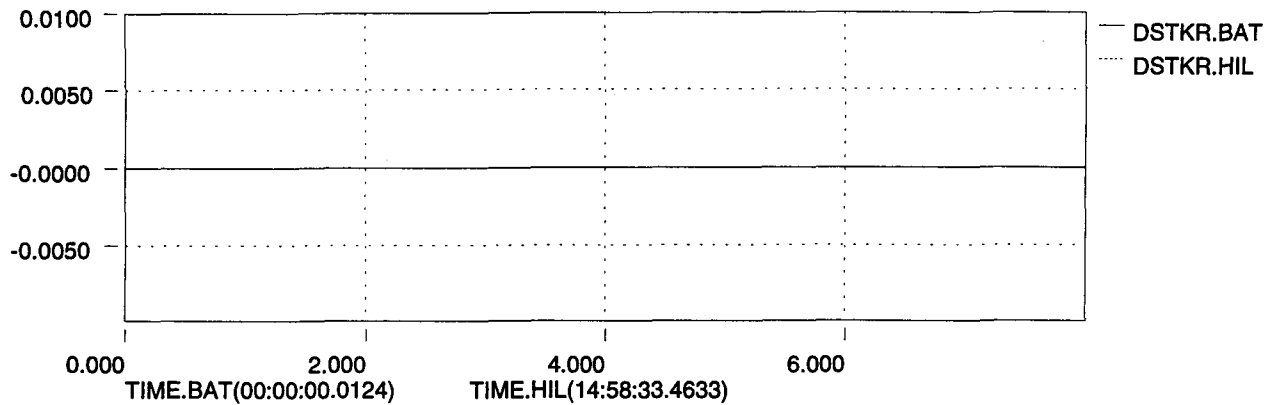
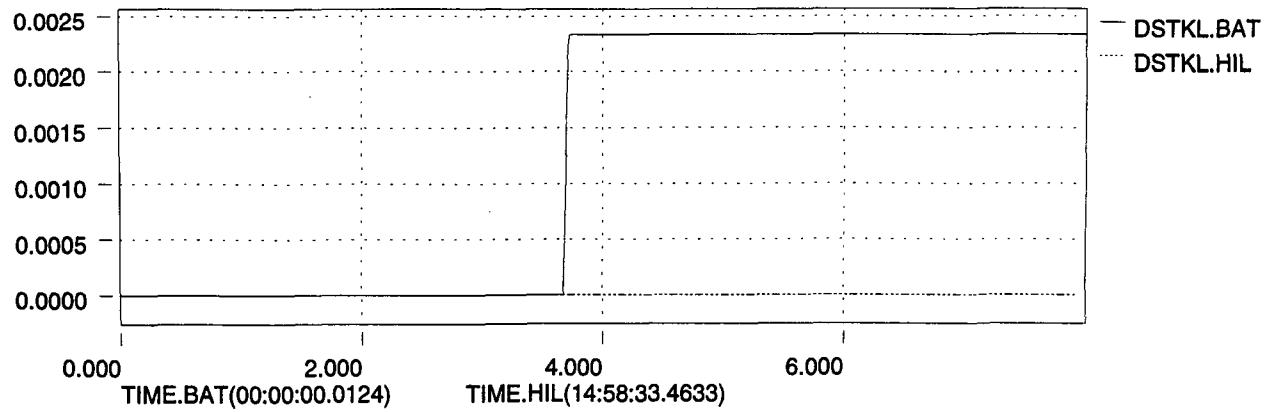
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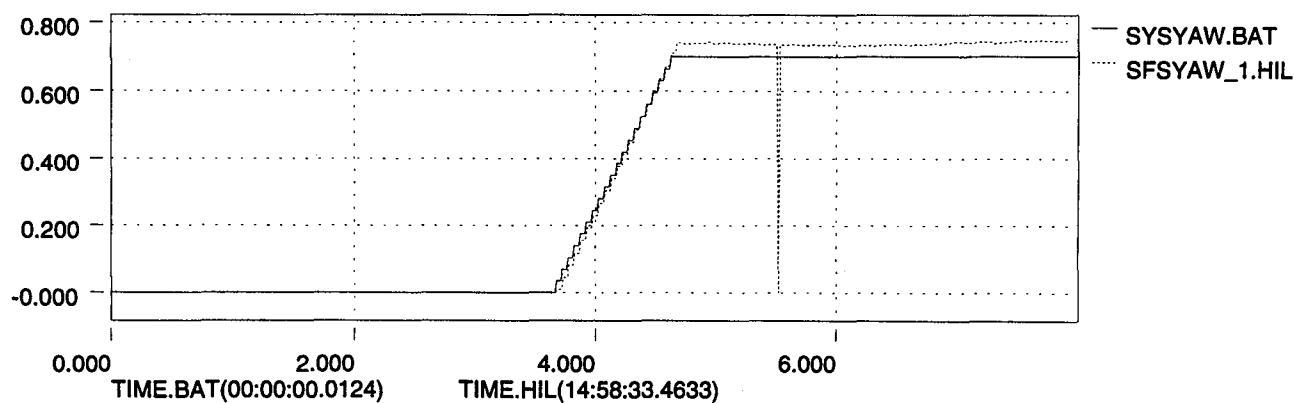
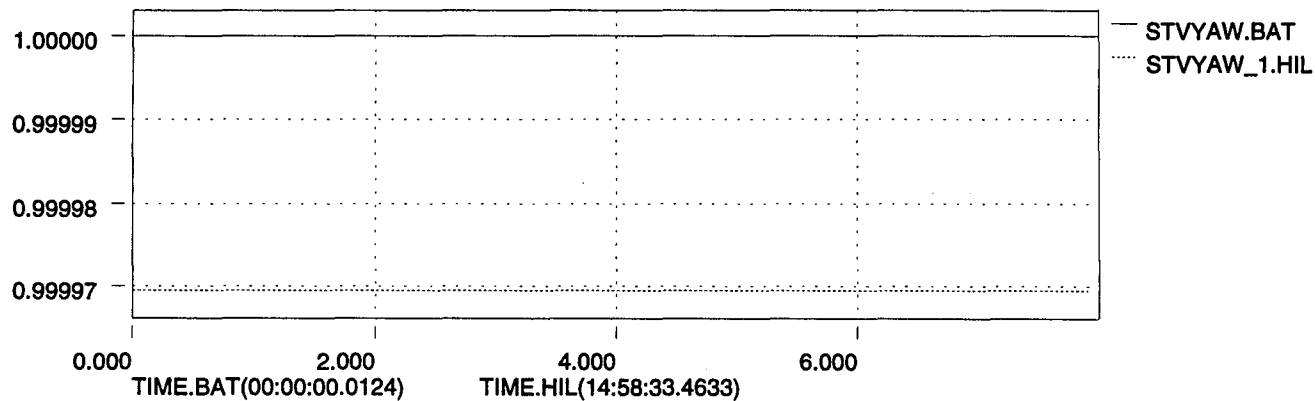
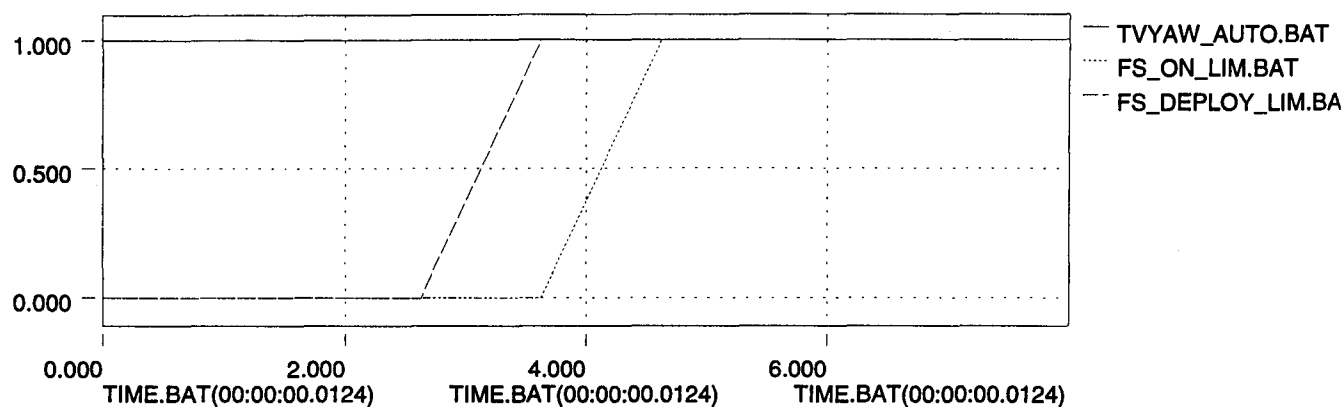
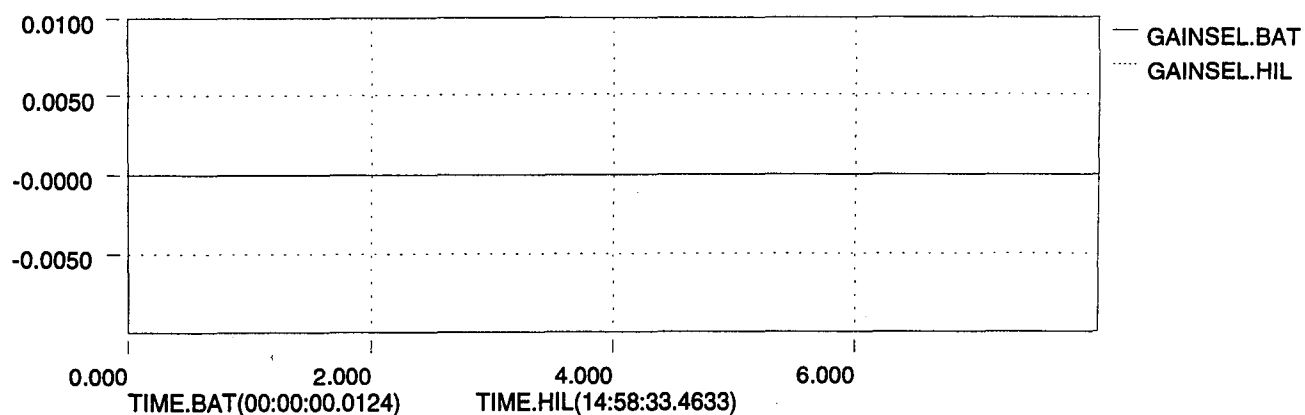
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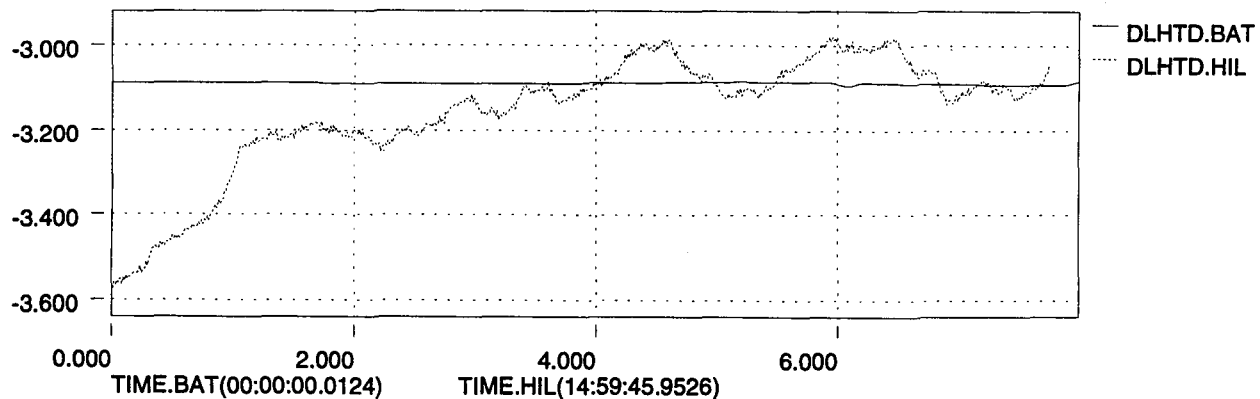
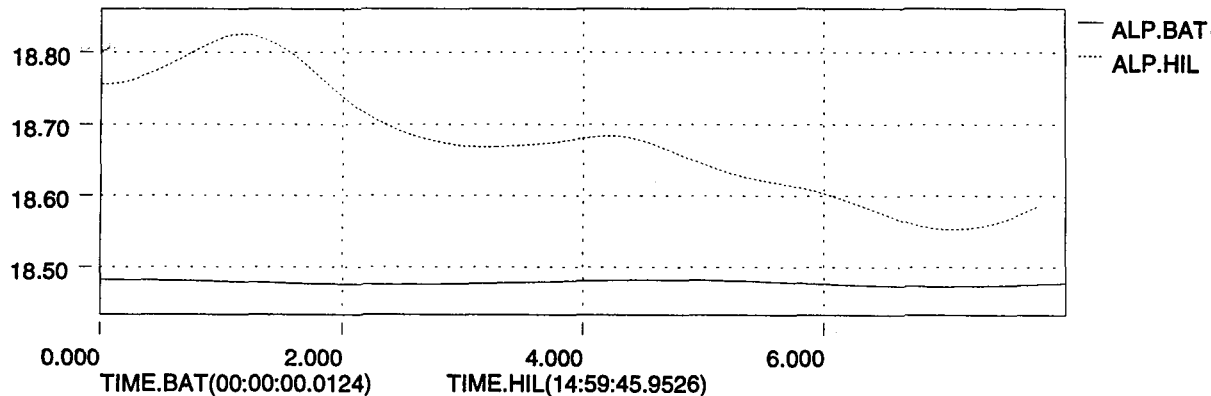
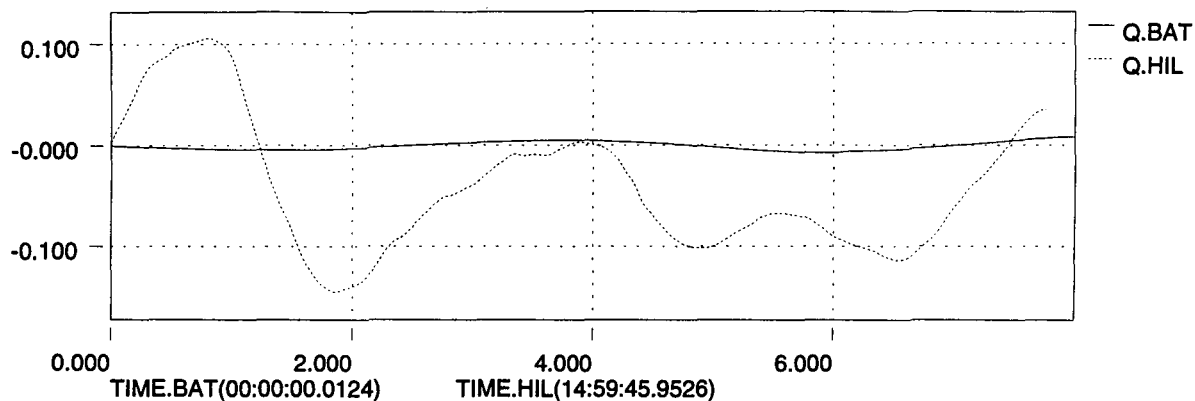
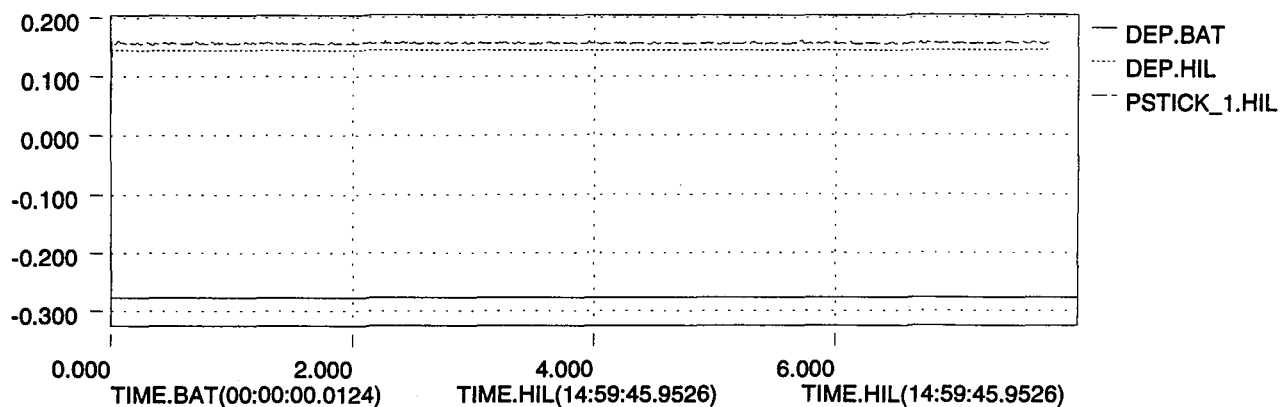
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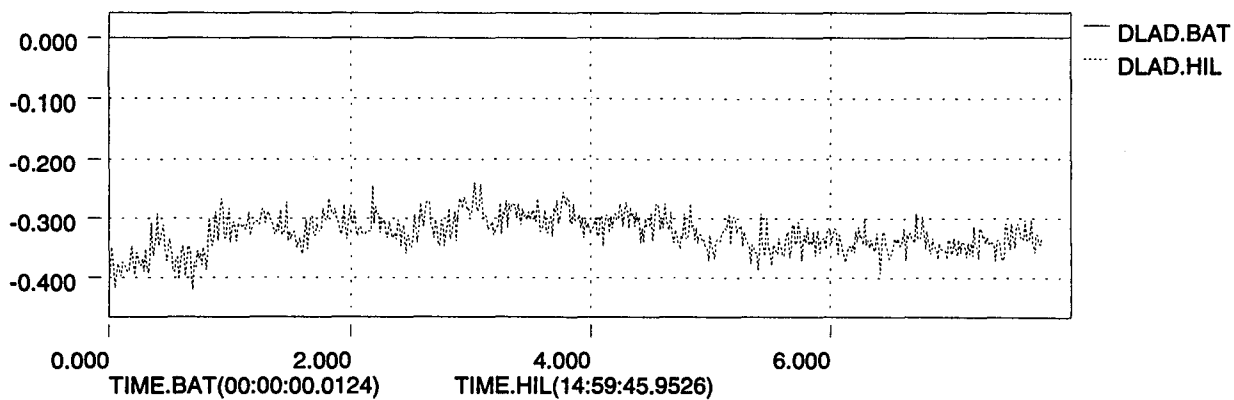
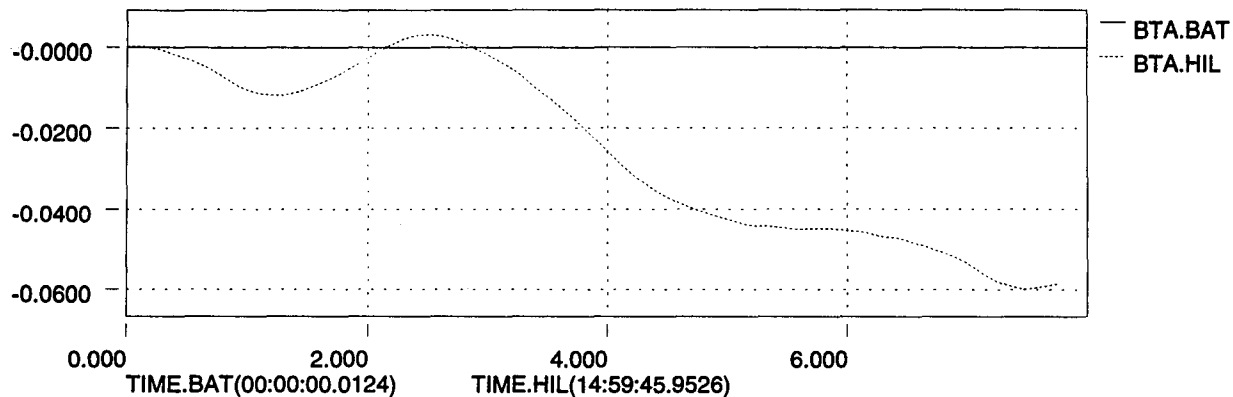
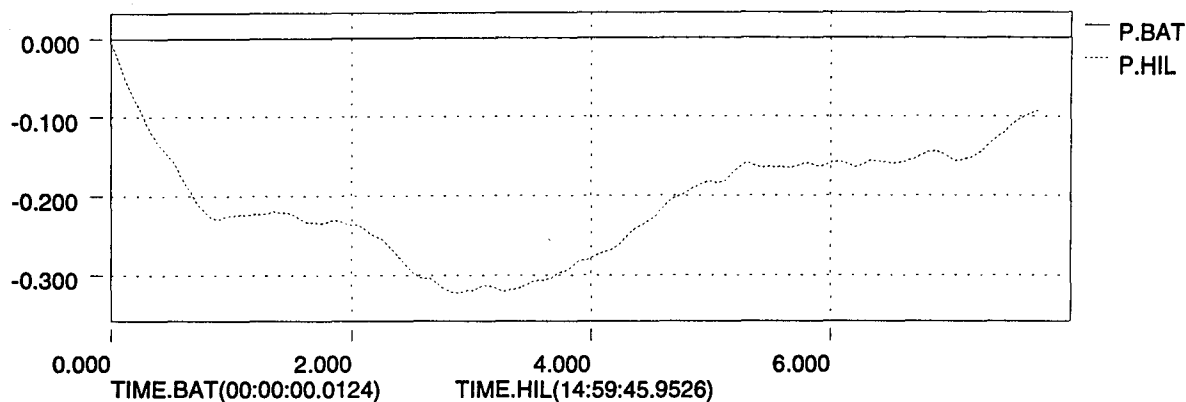
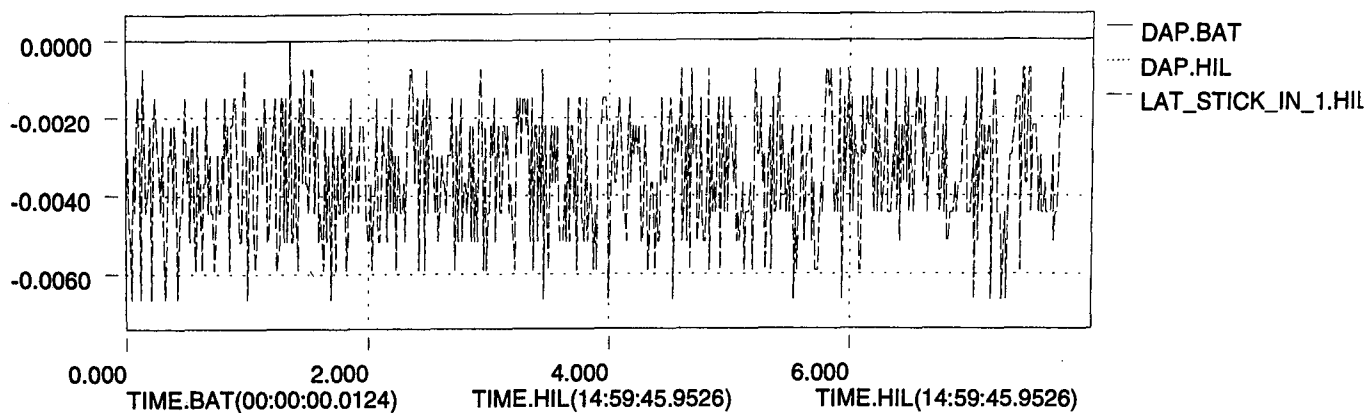
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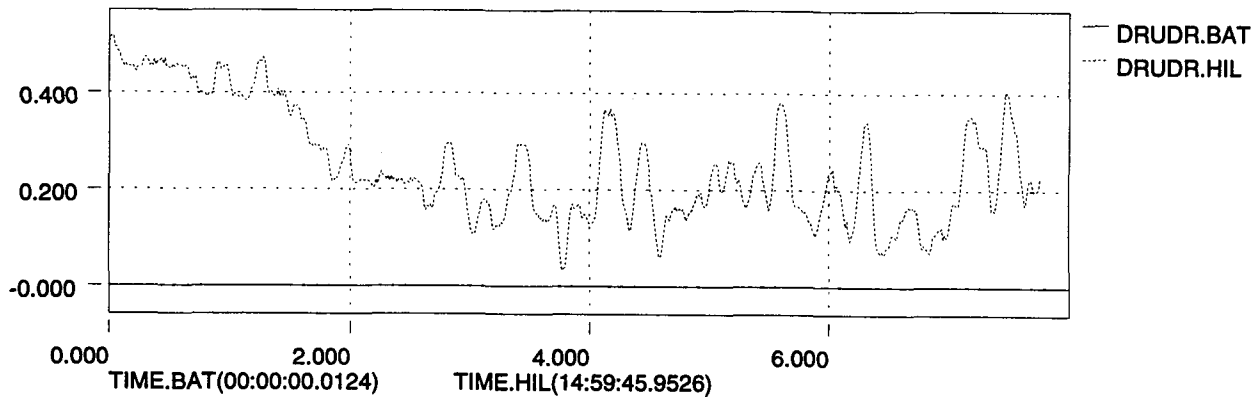
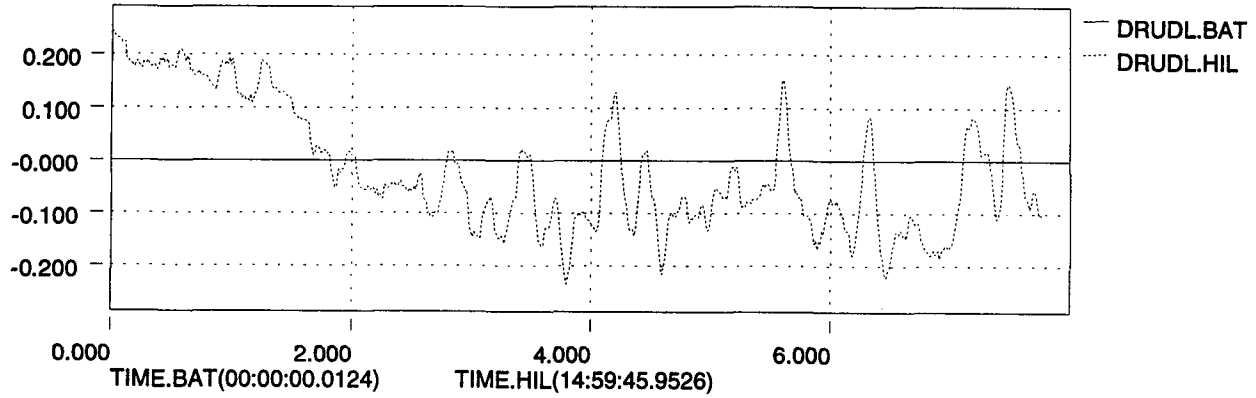
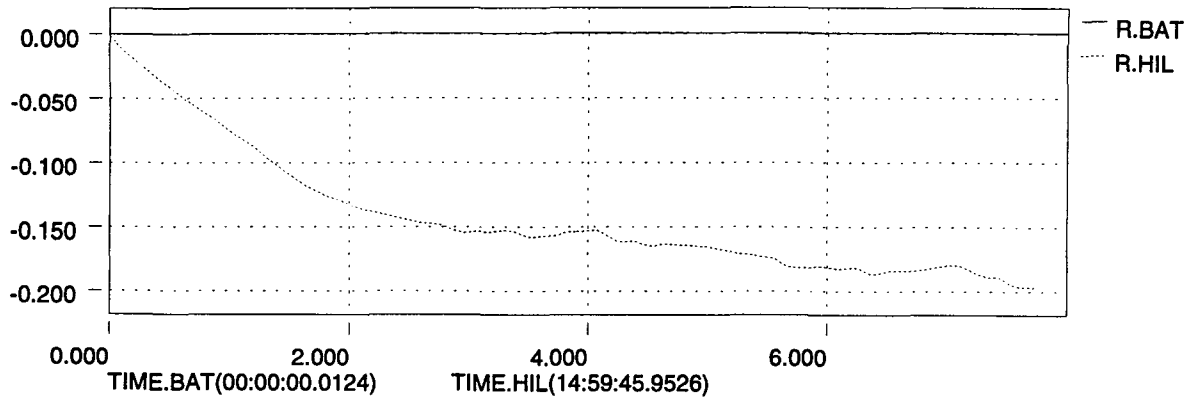
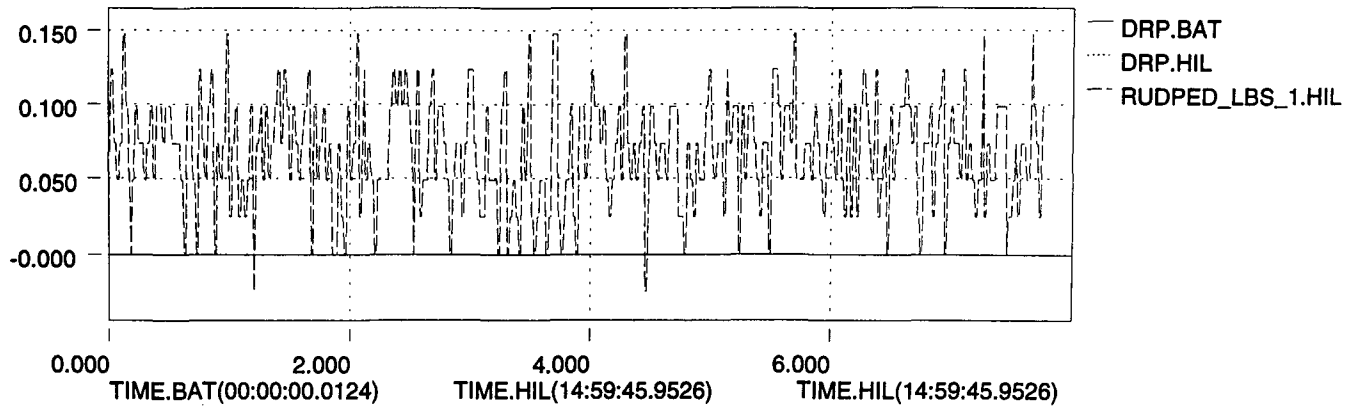
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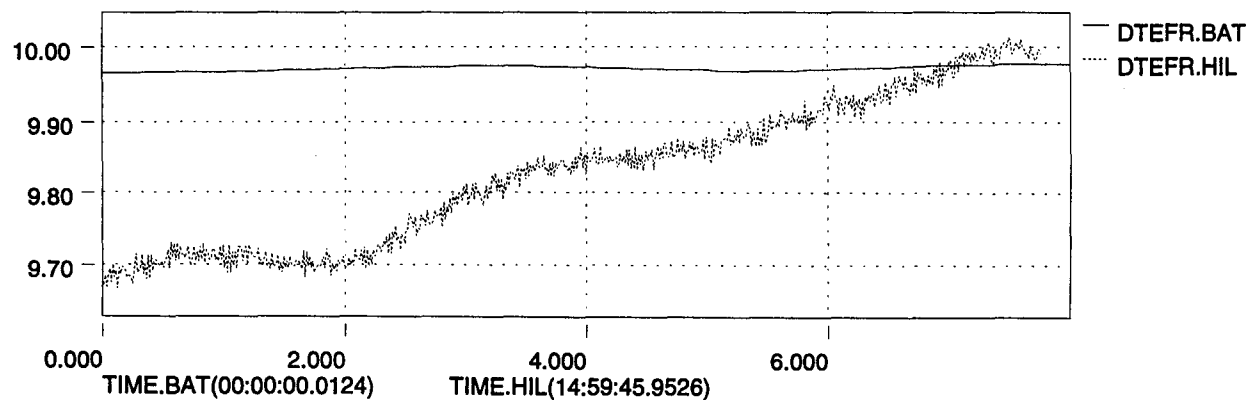
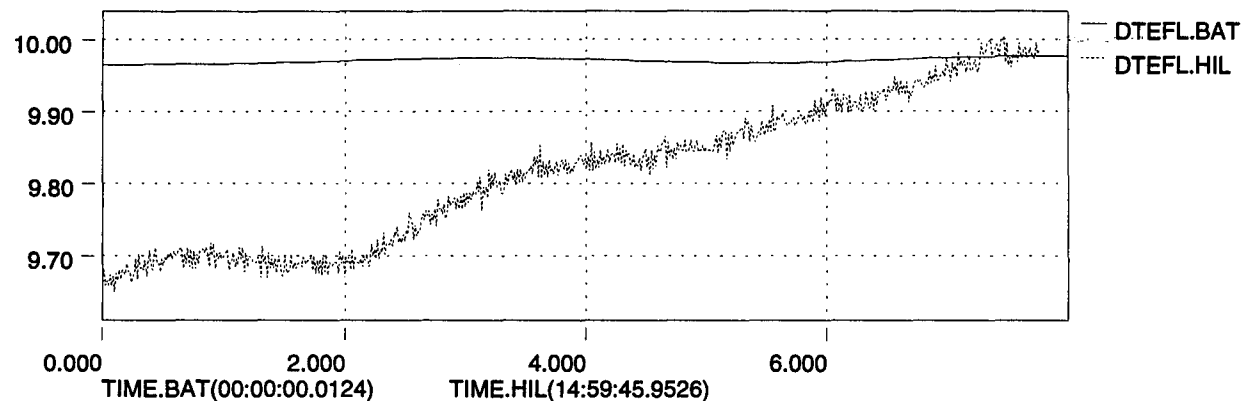
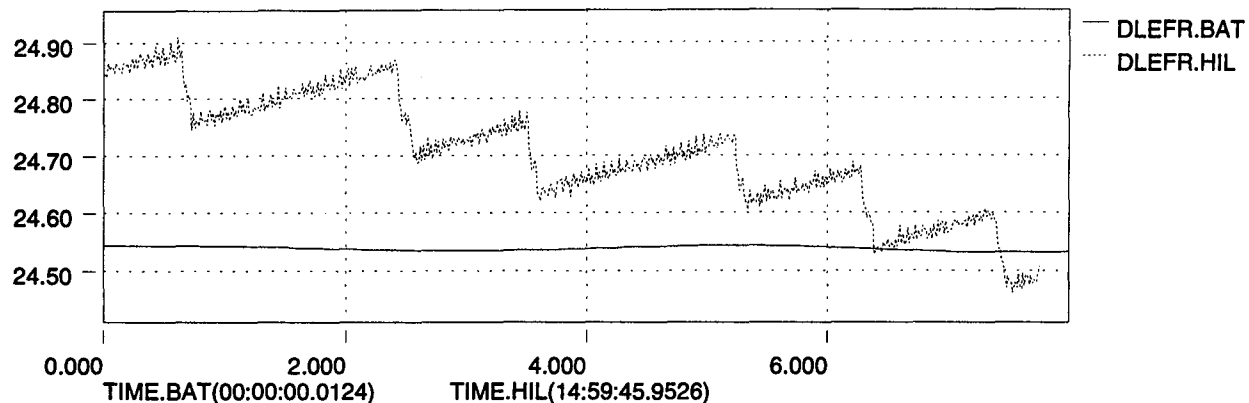
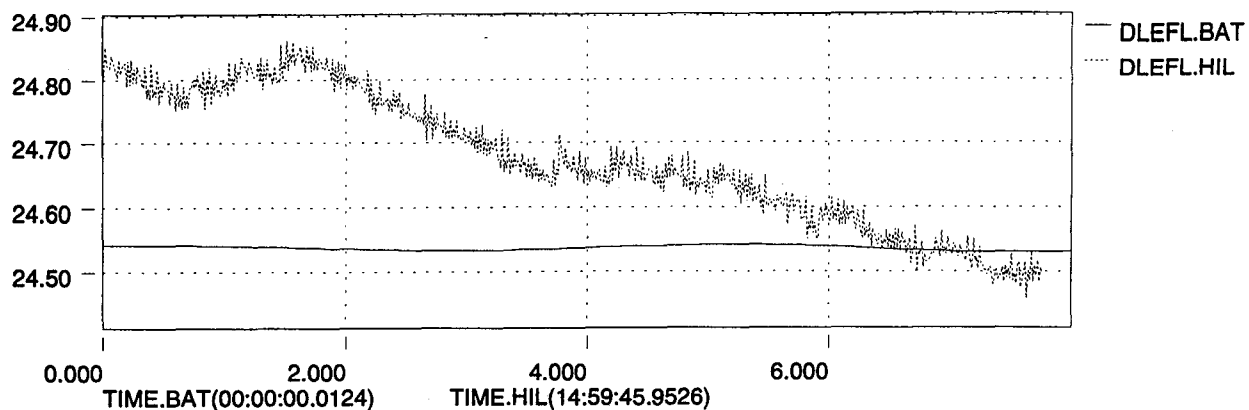
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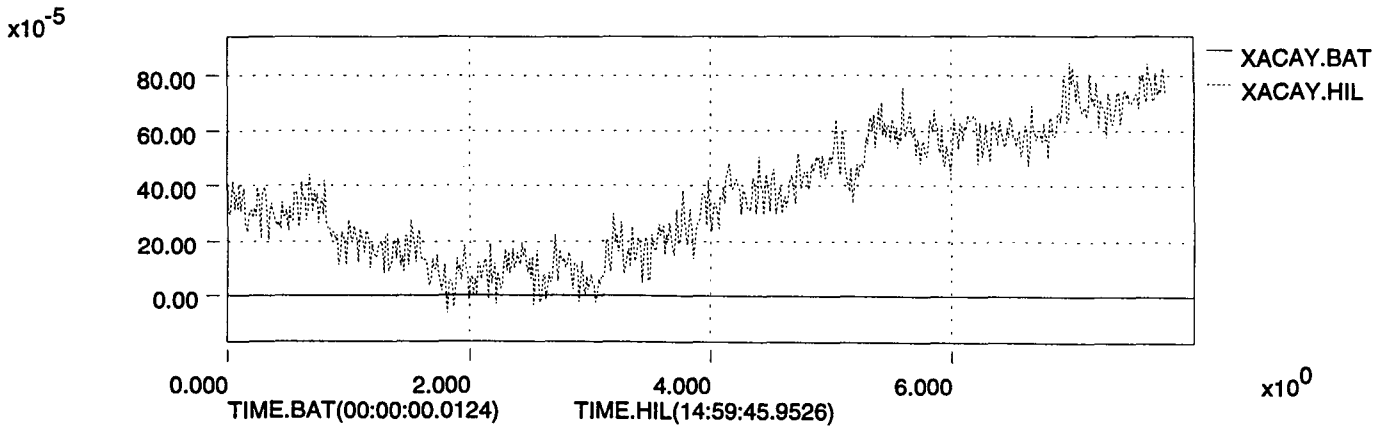
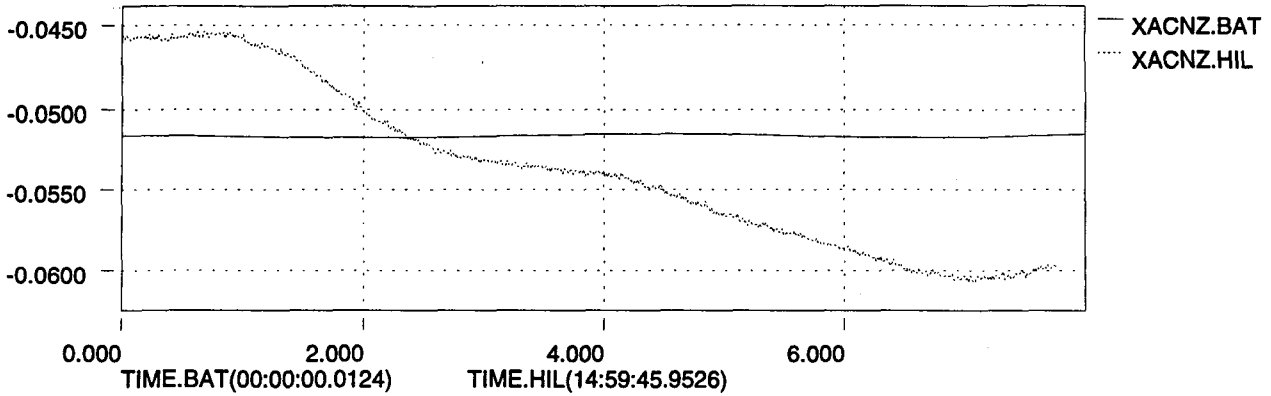
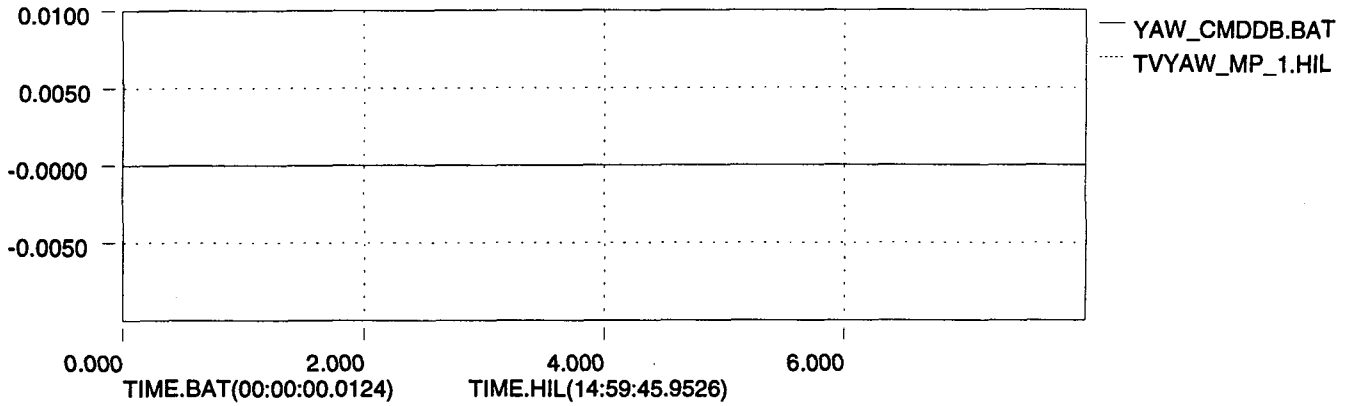
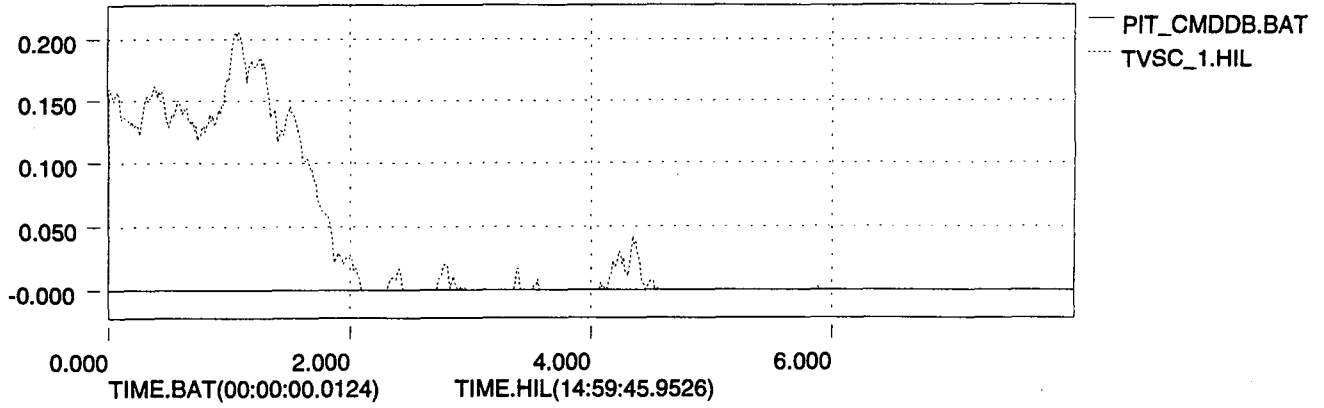
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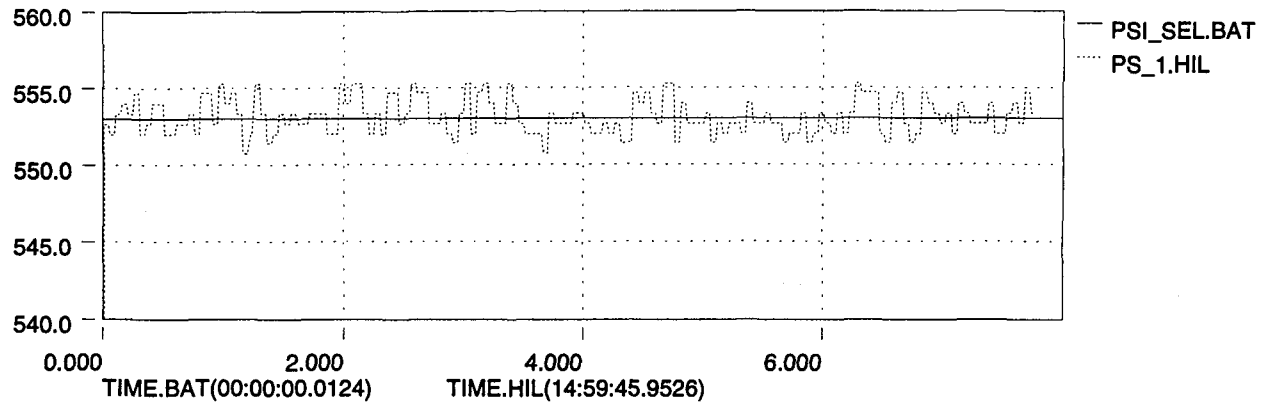
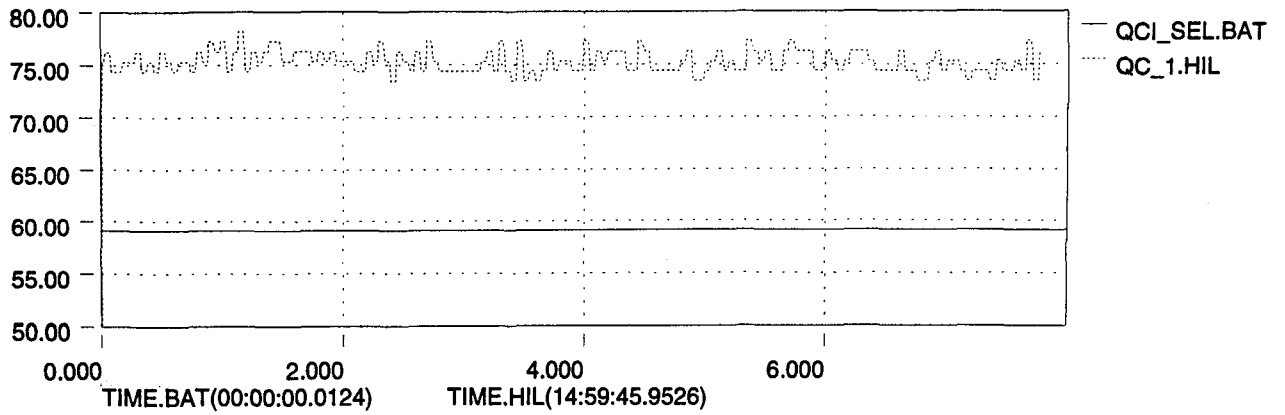
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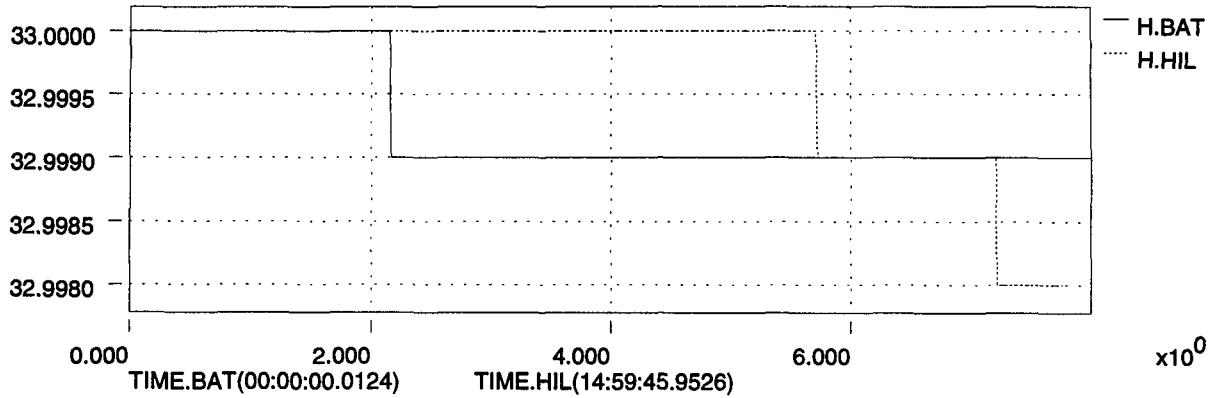


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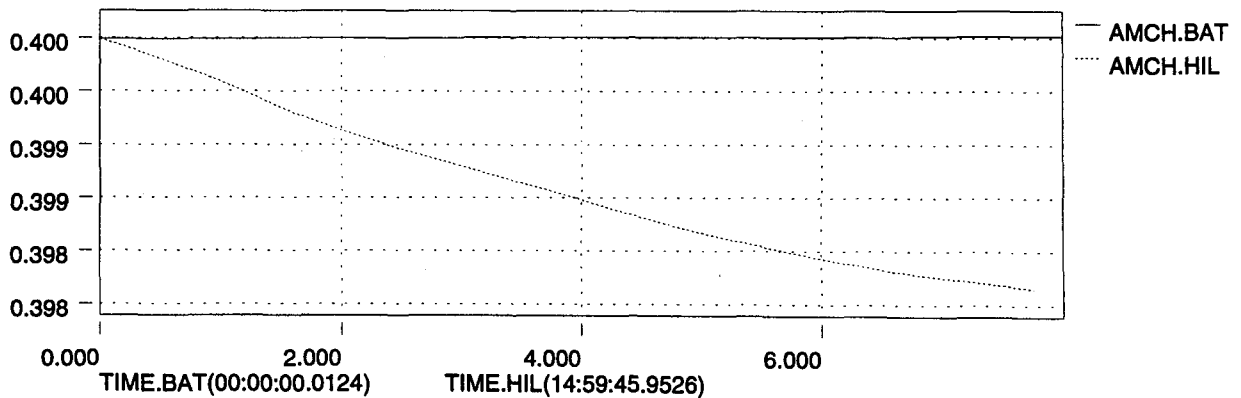
415



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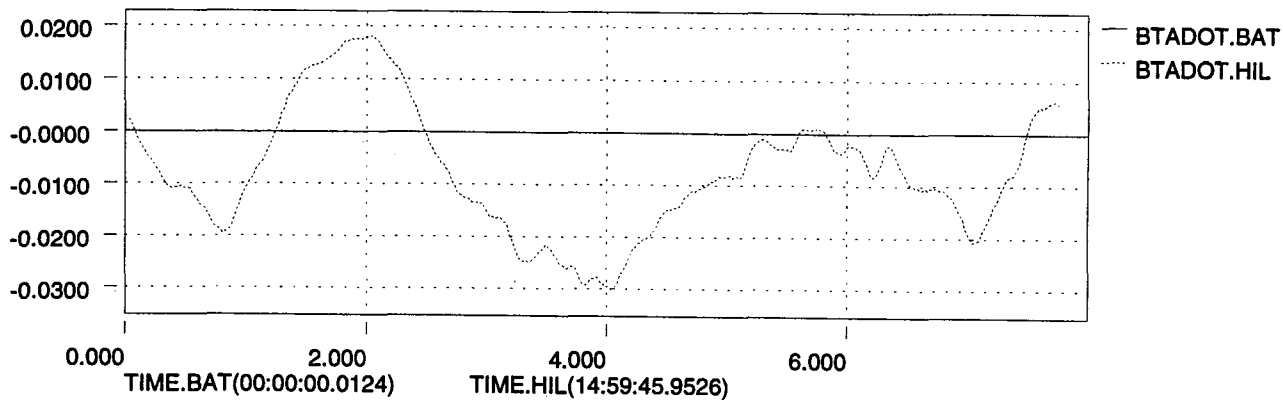
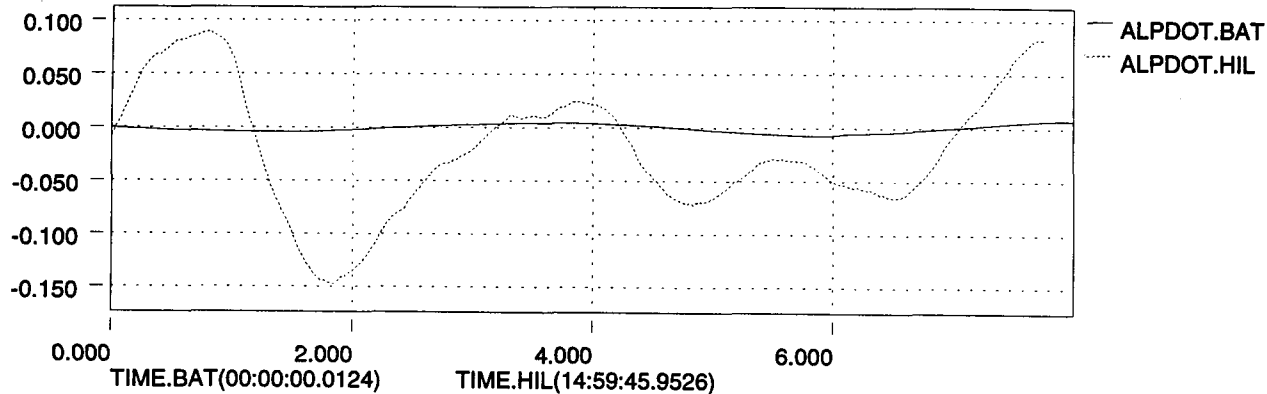
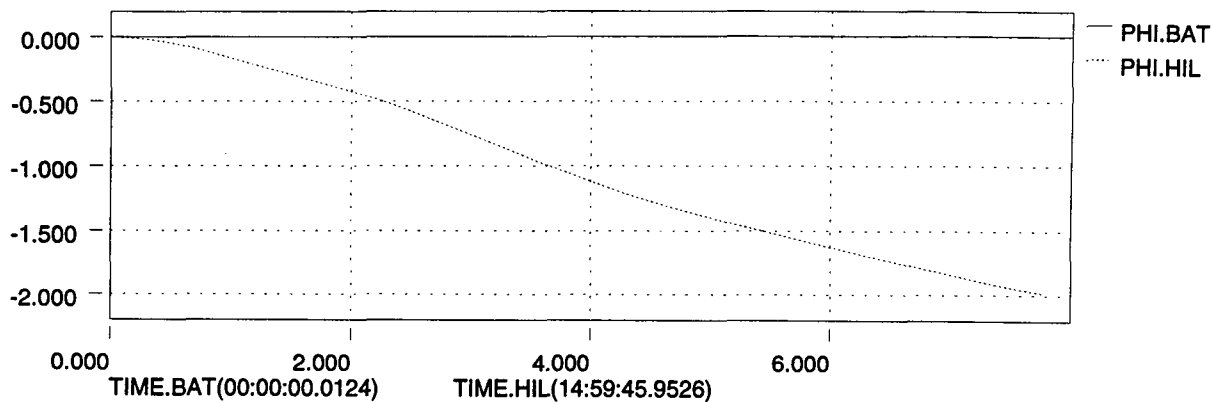
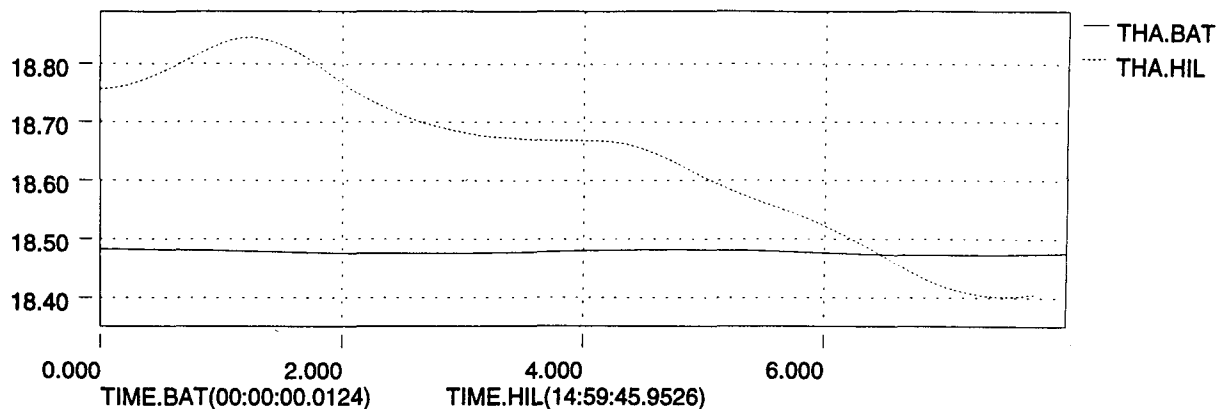


$\times 10^0$



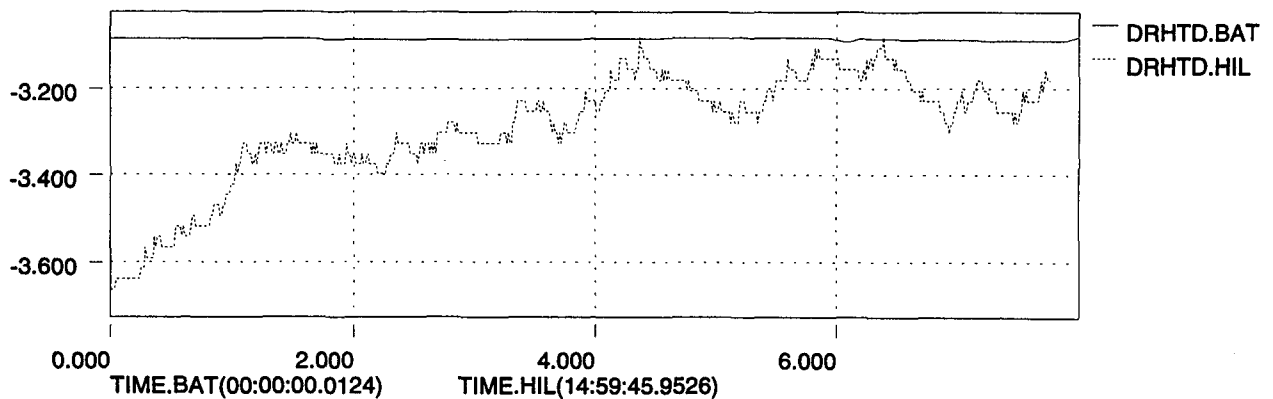
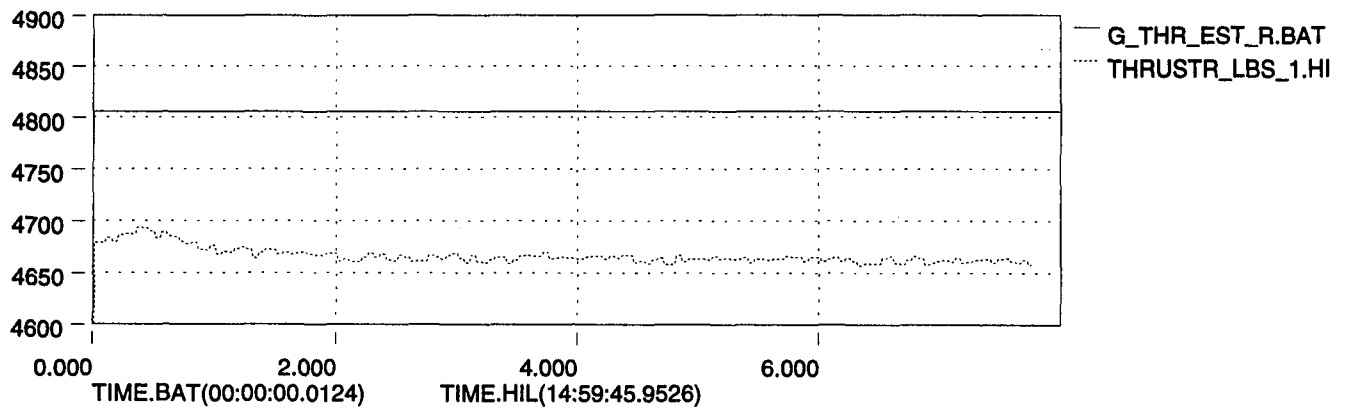
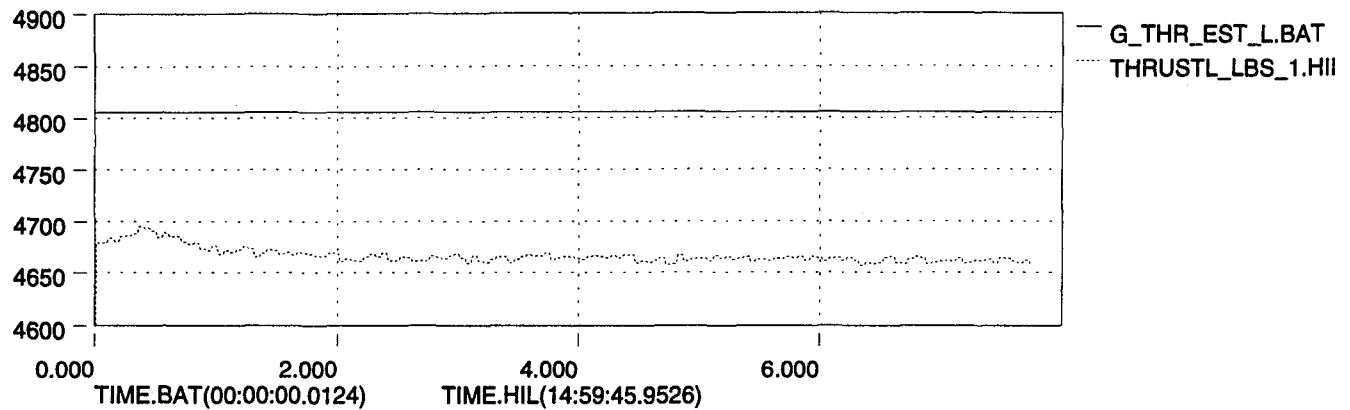
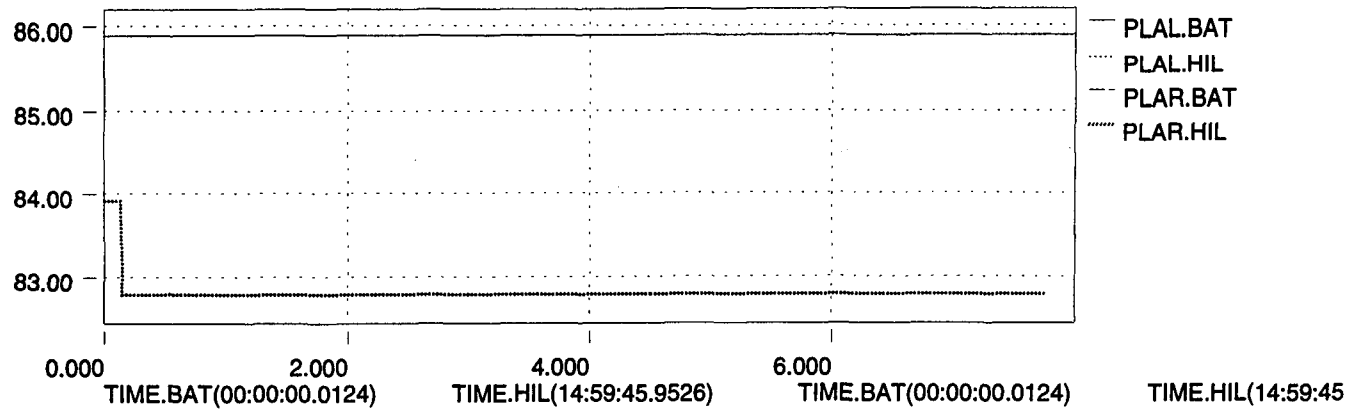
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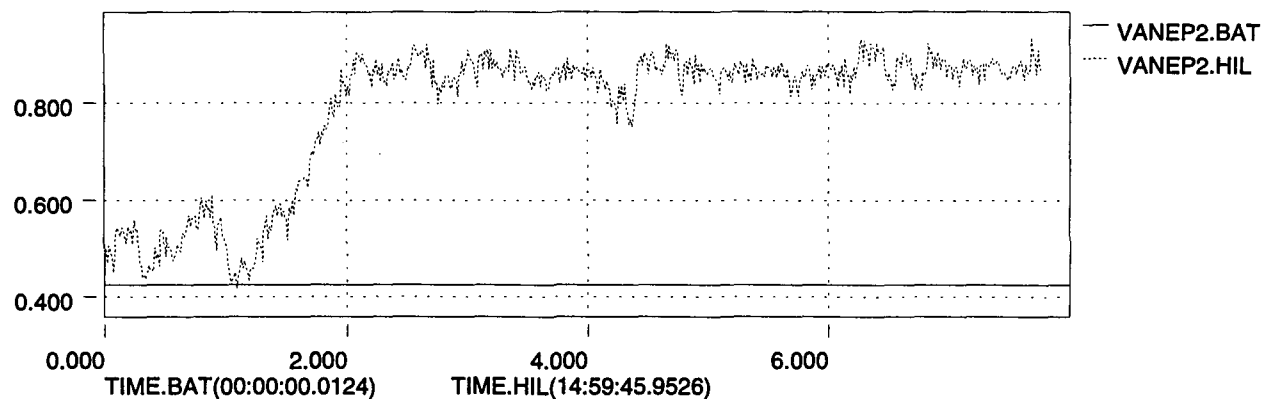
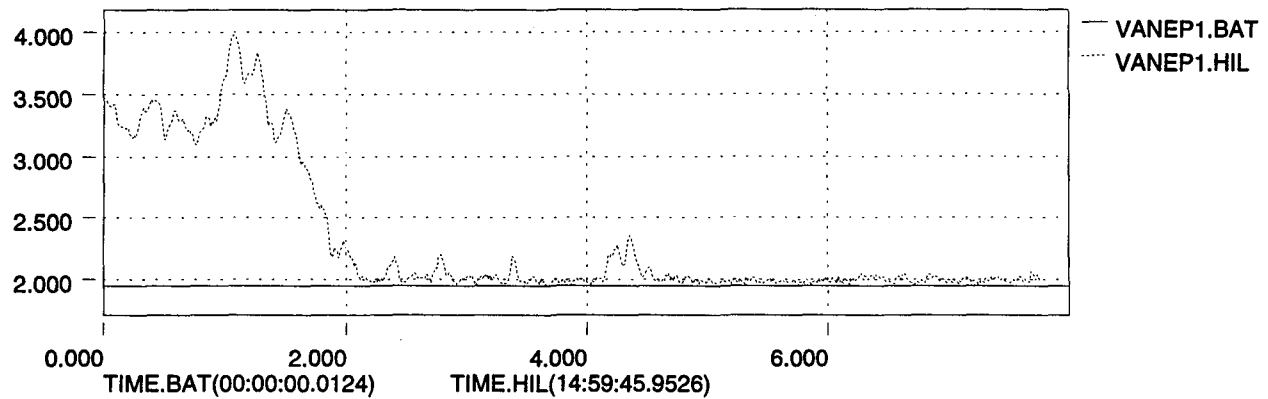
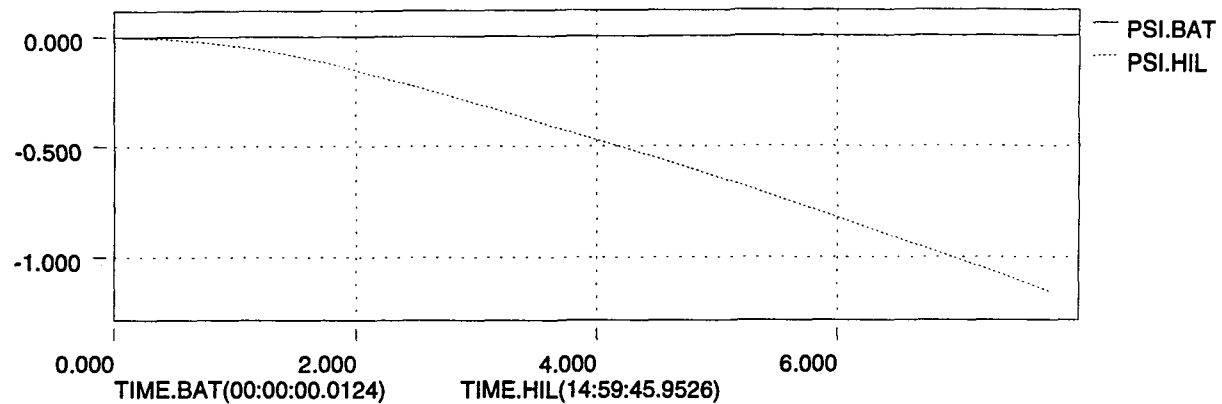
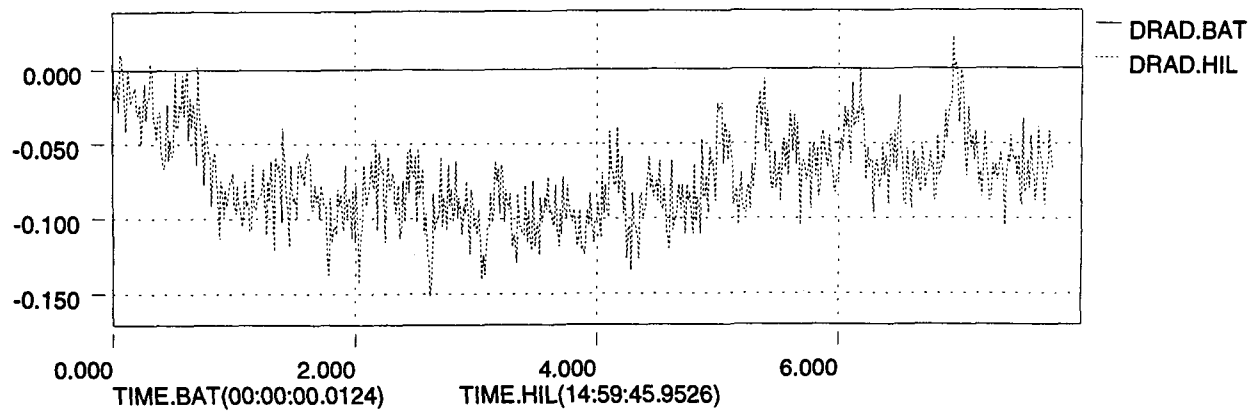
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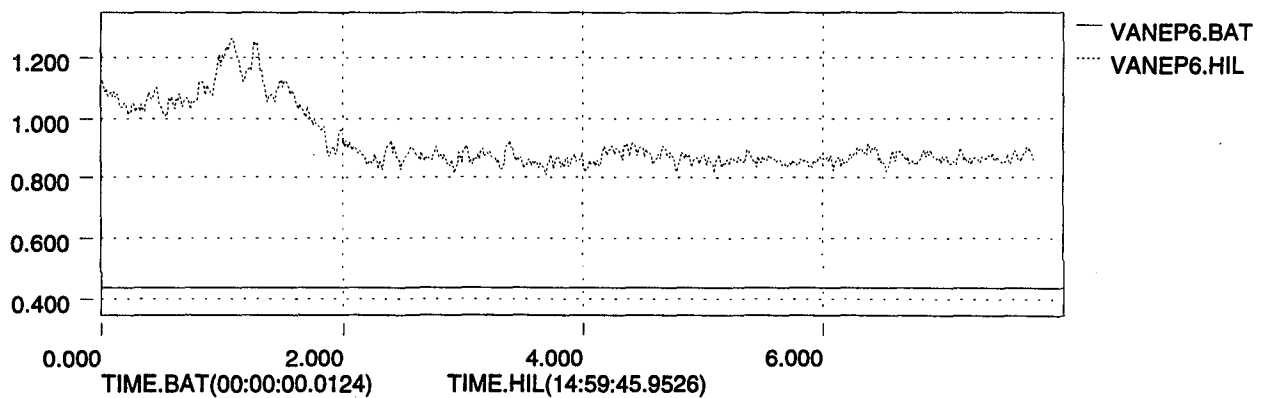
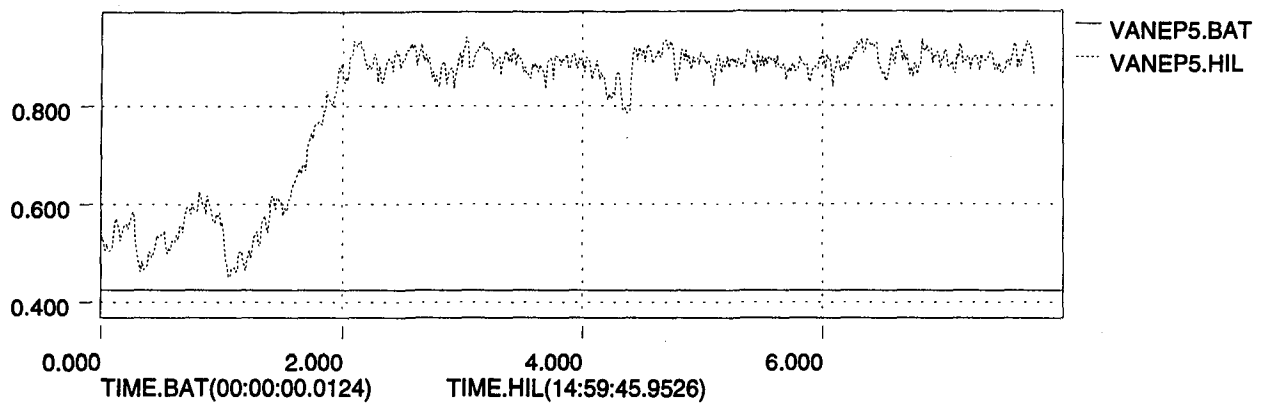
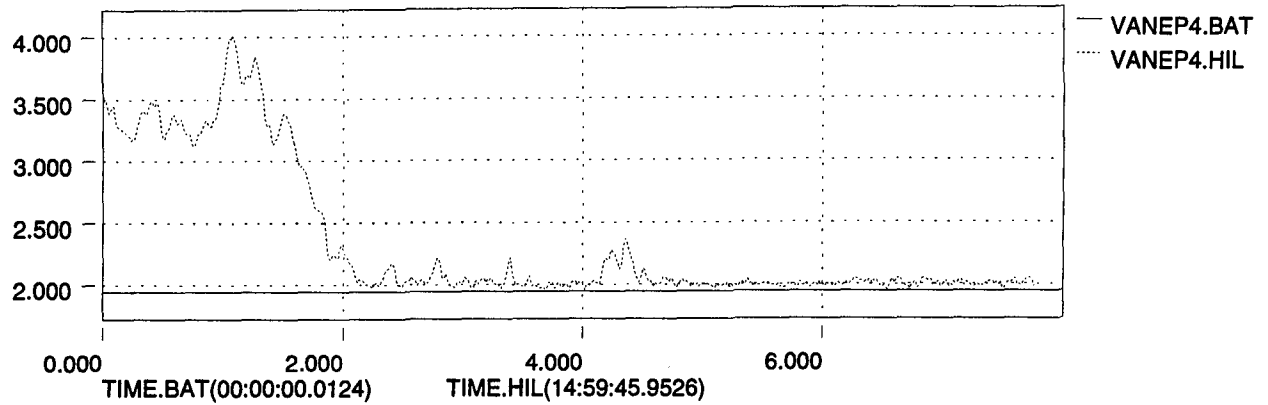
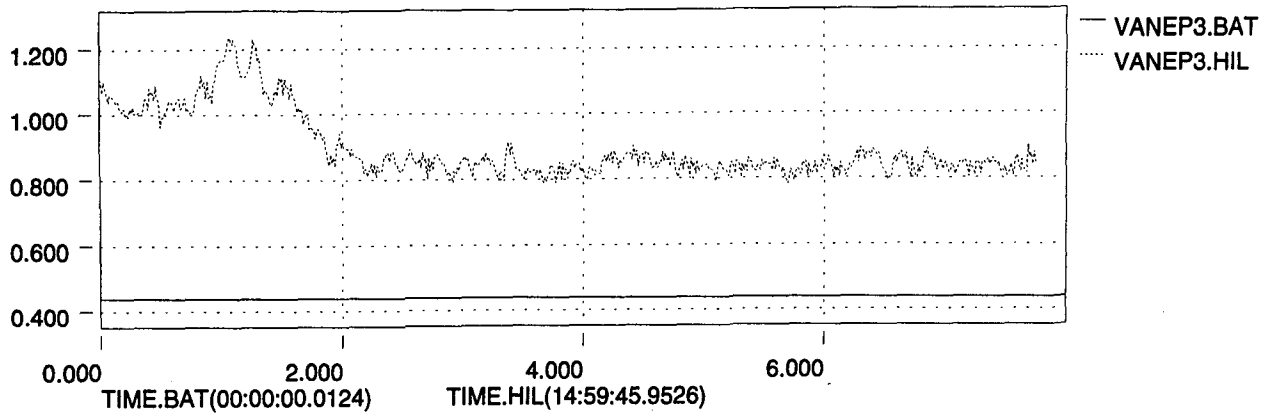
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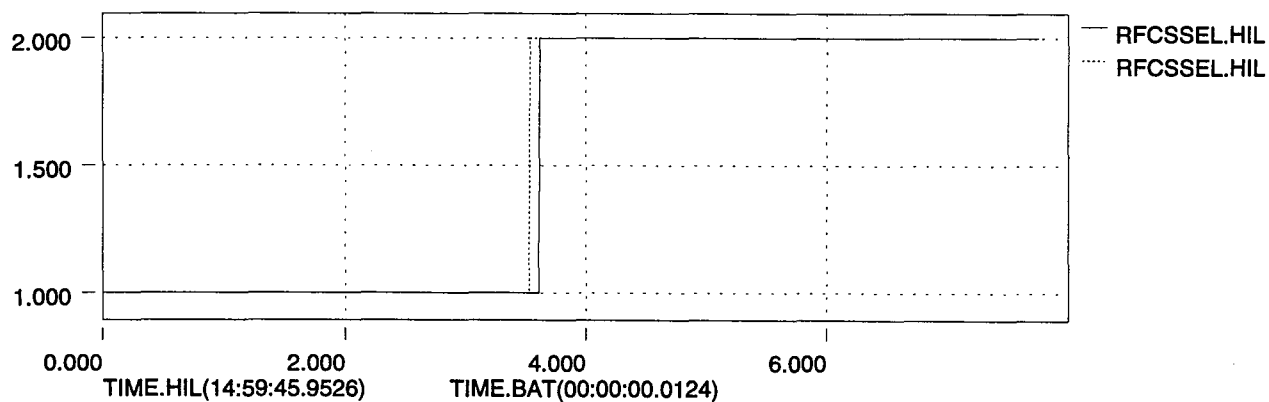
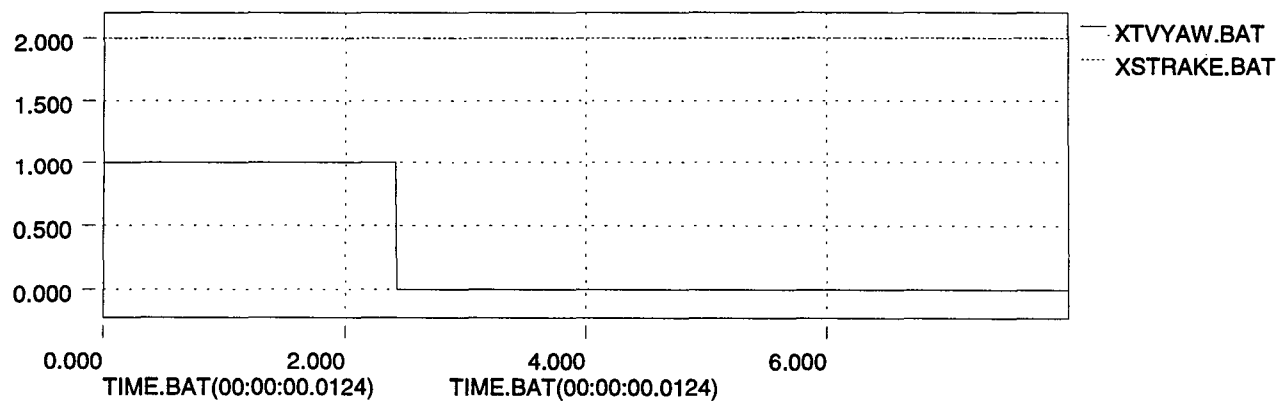
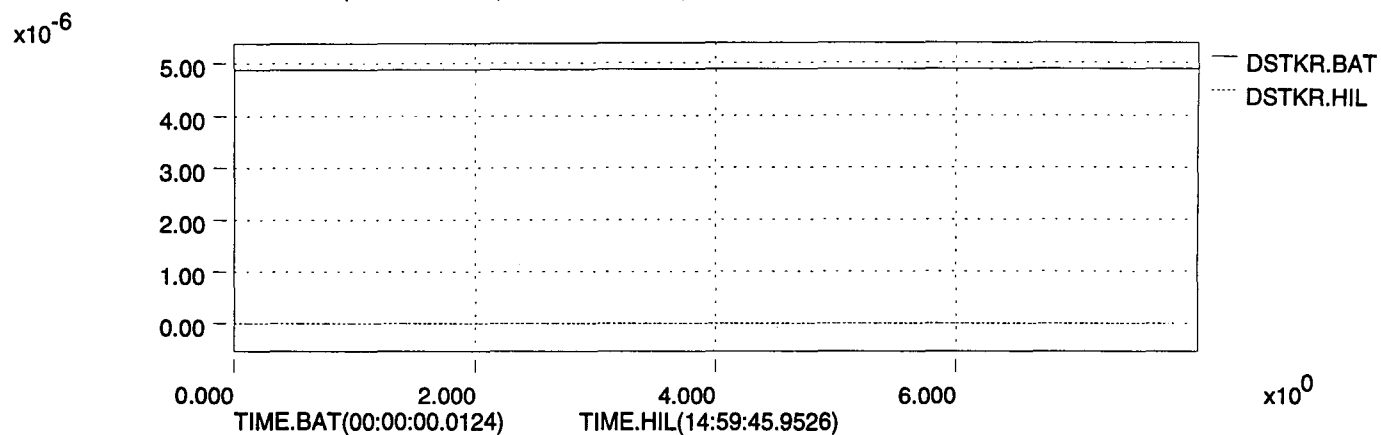
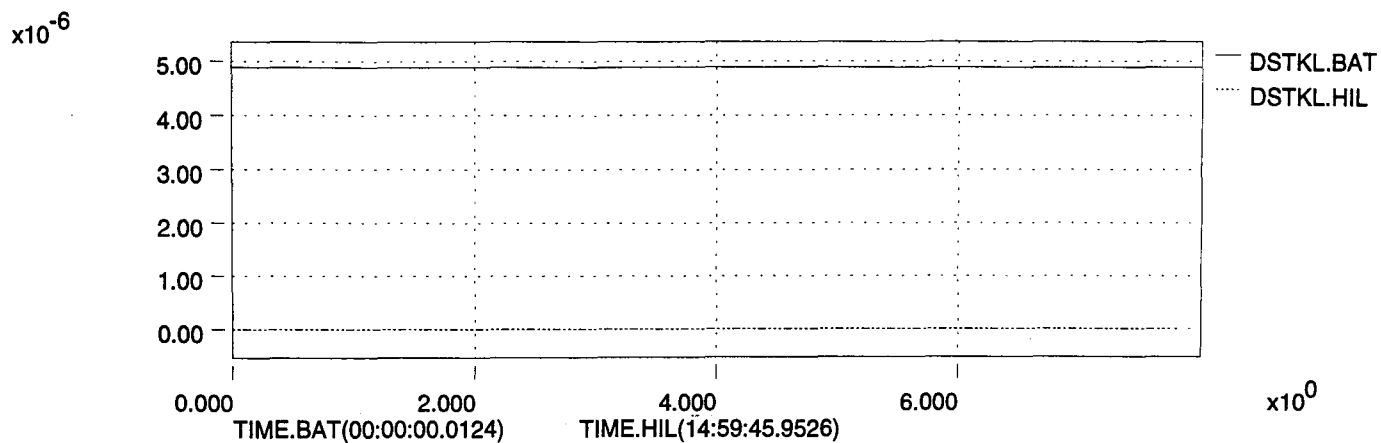
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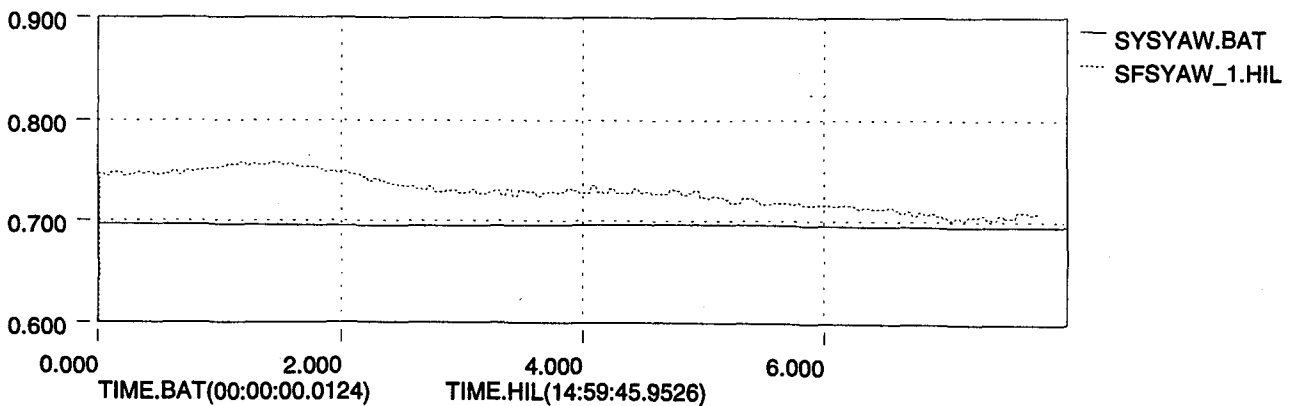
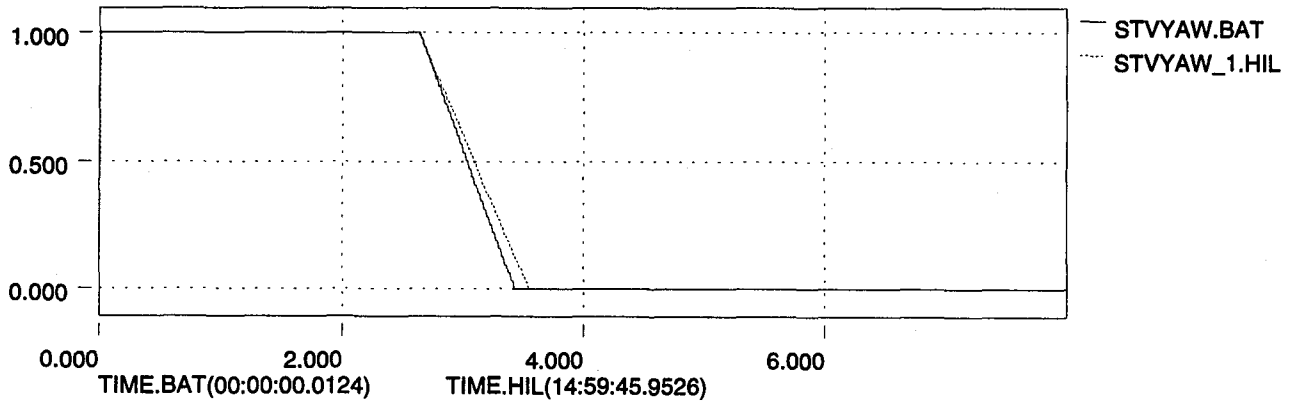
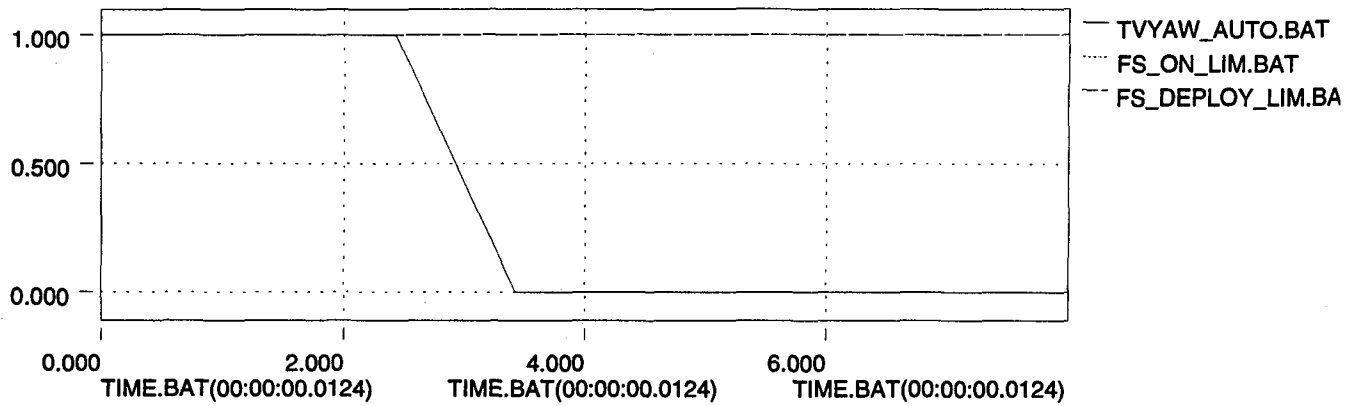
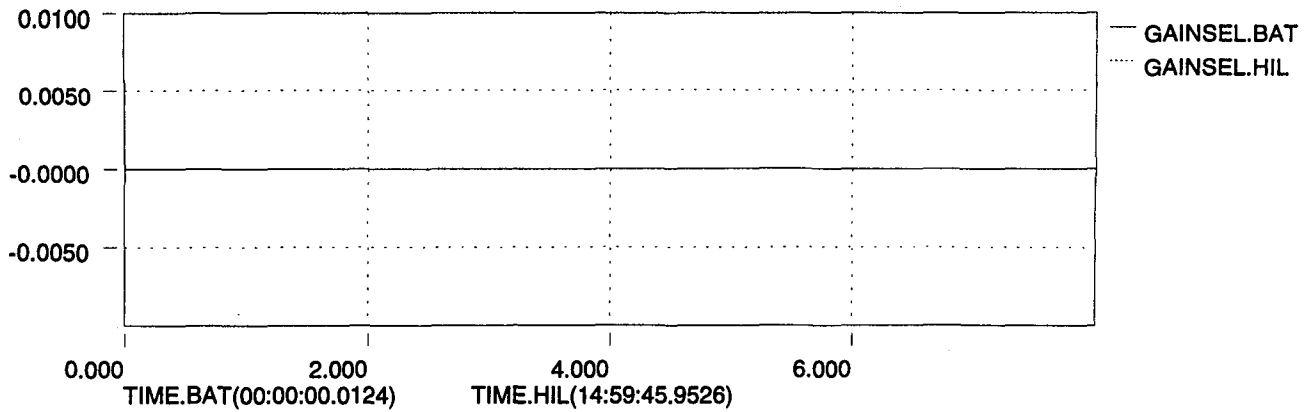
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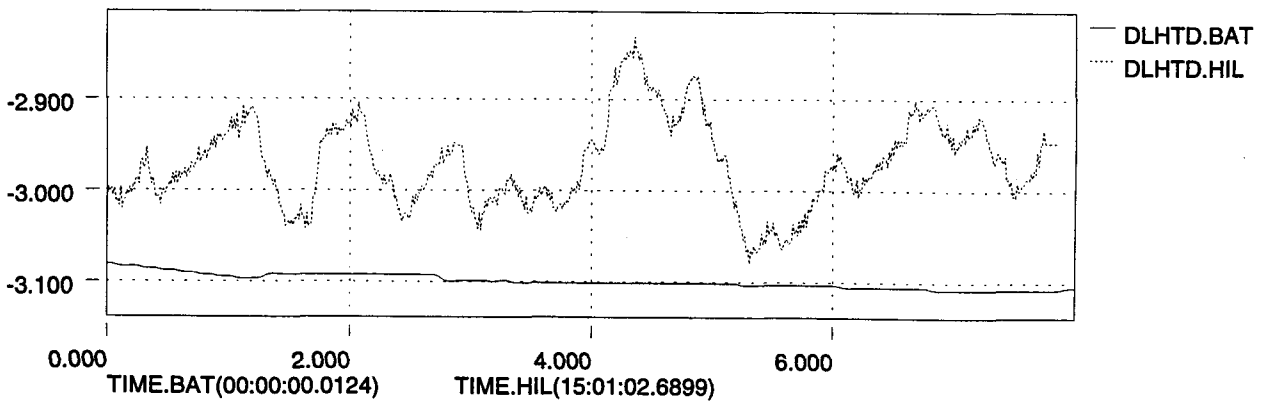
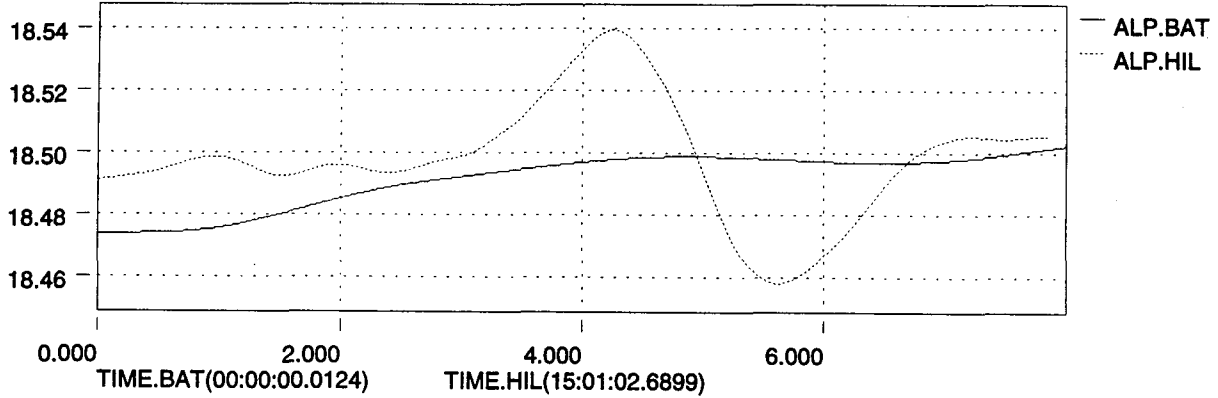
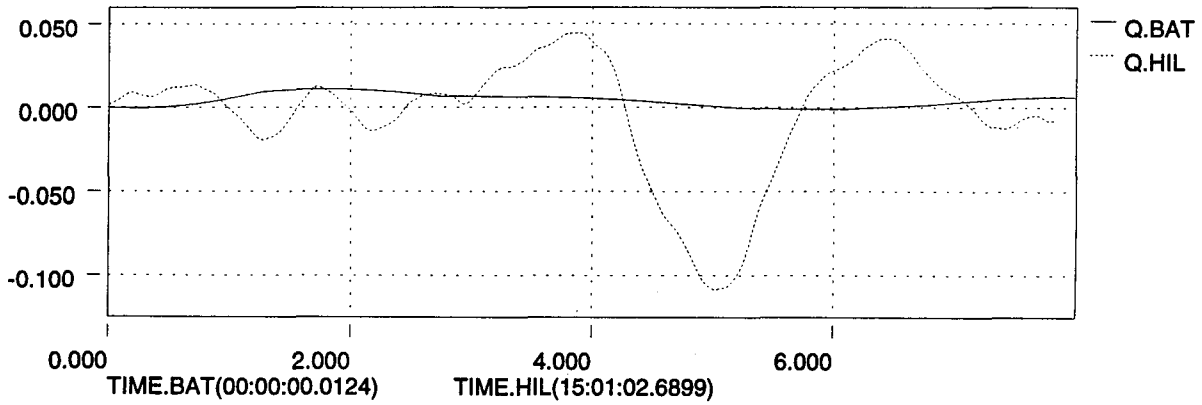
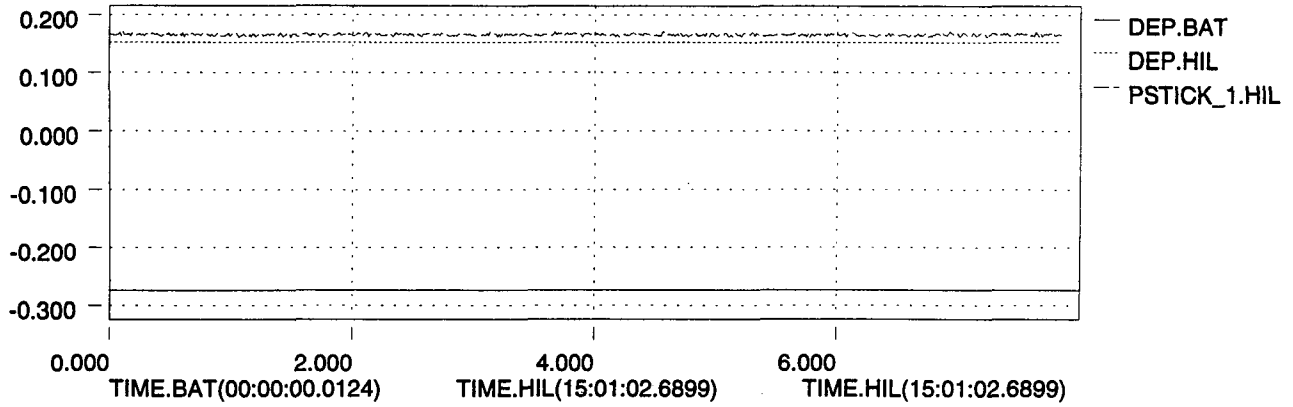
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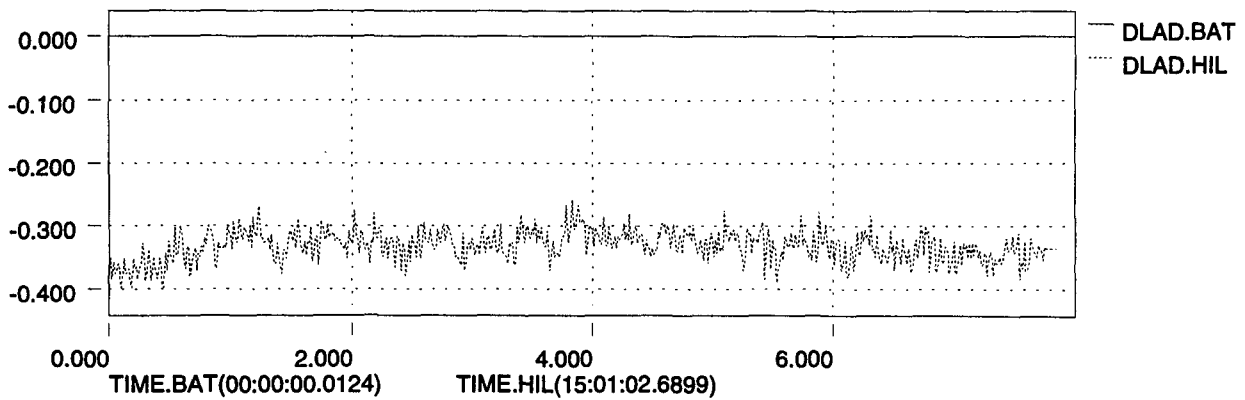
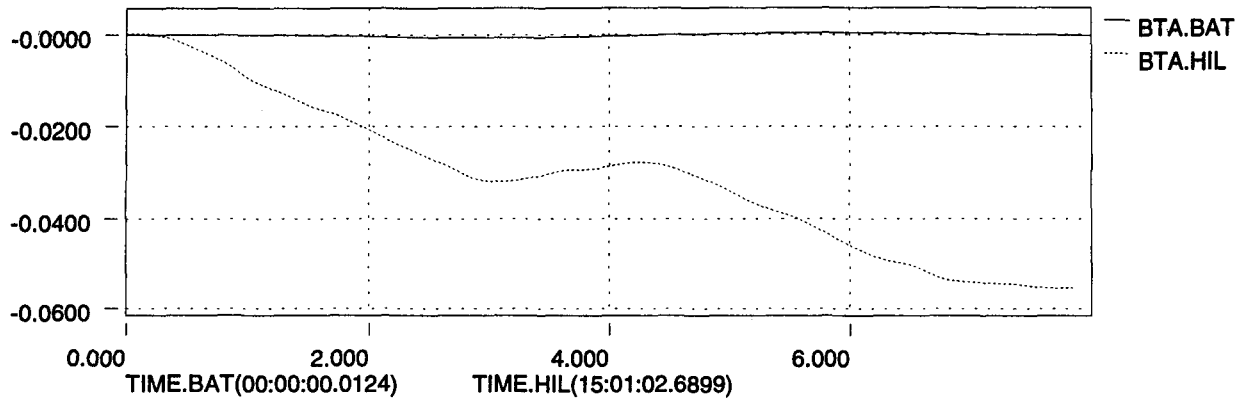
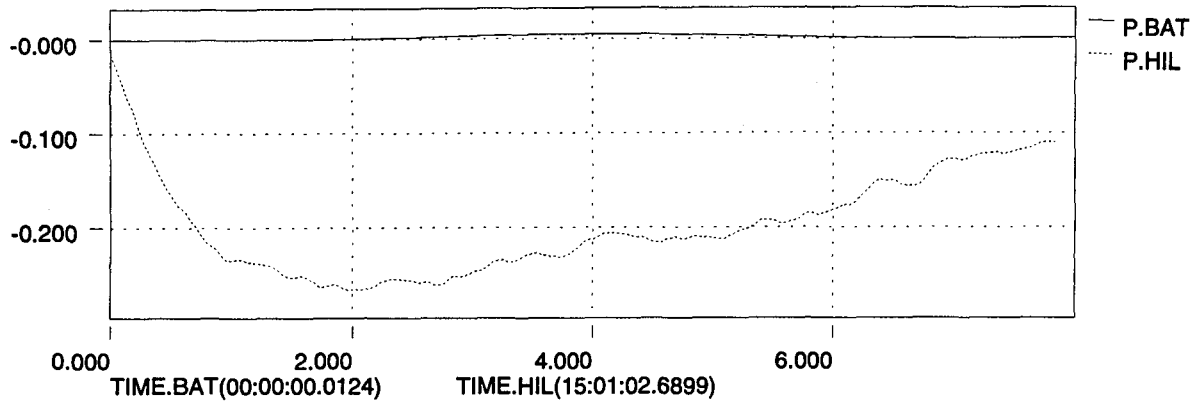
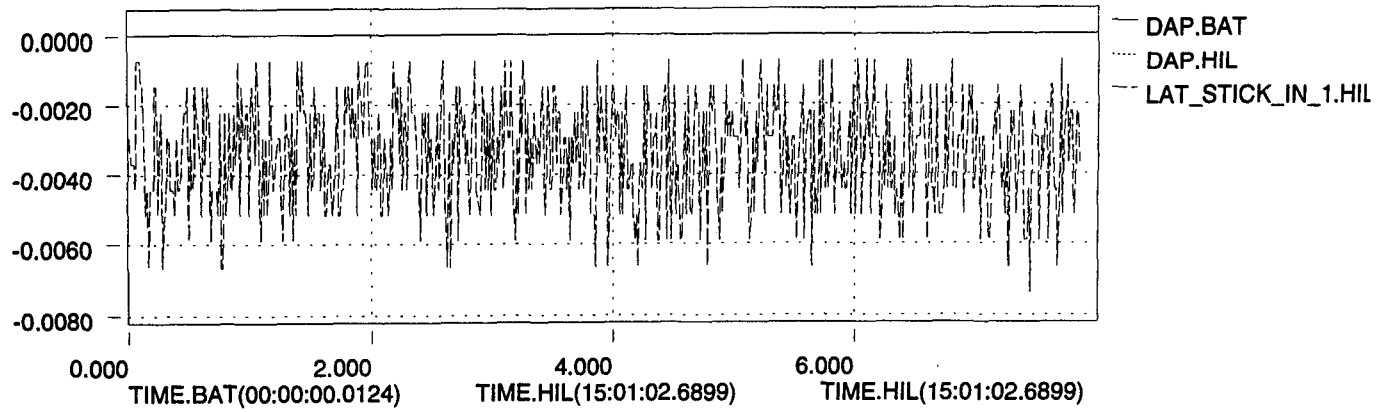
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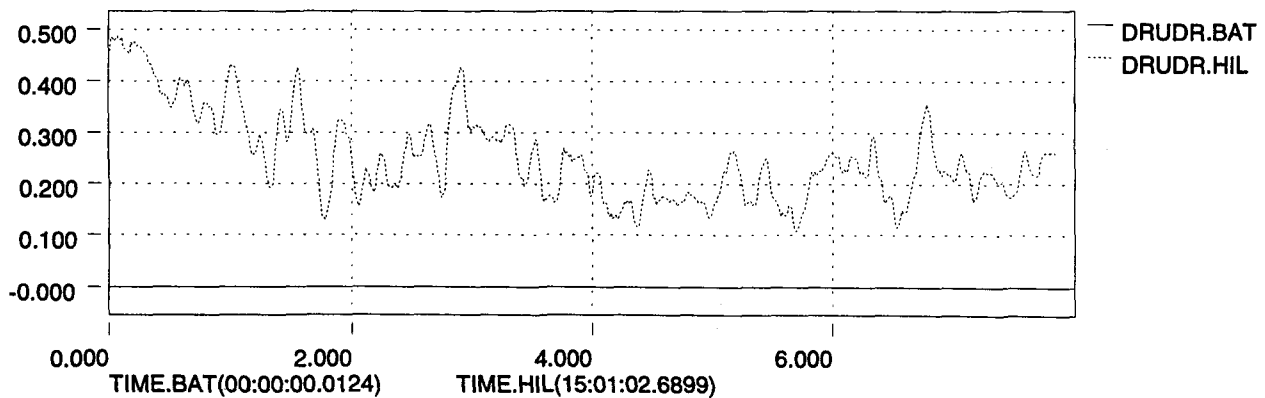
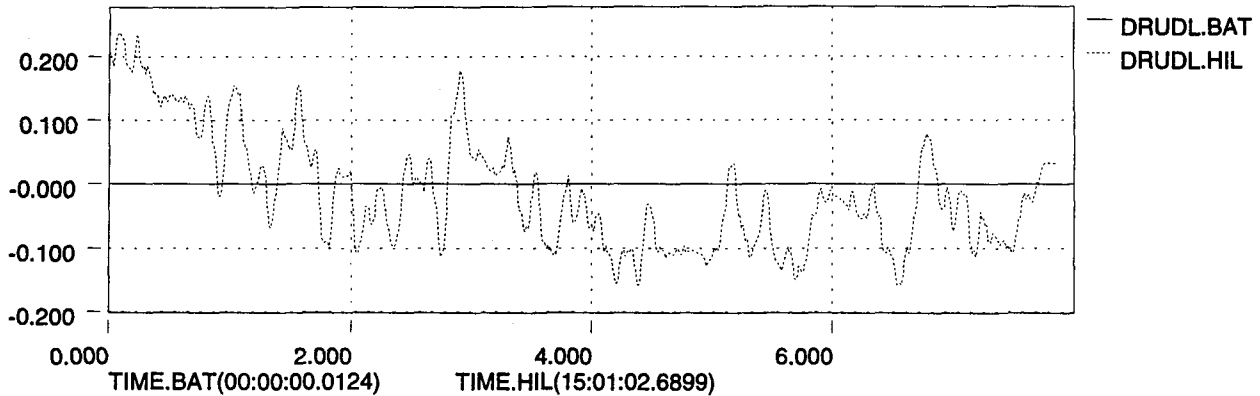
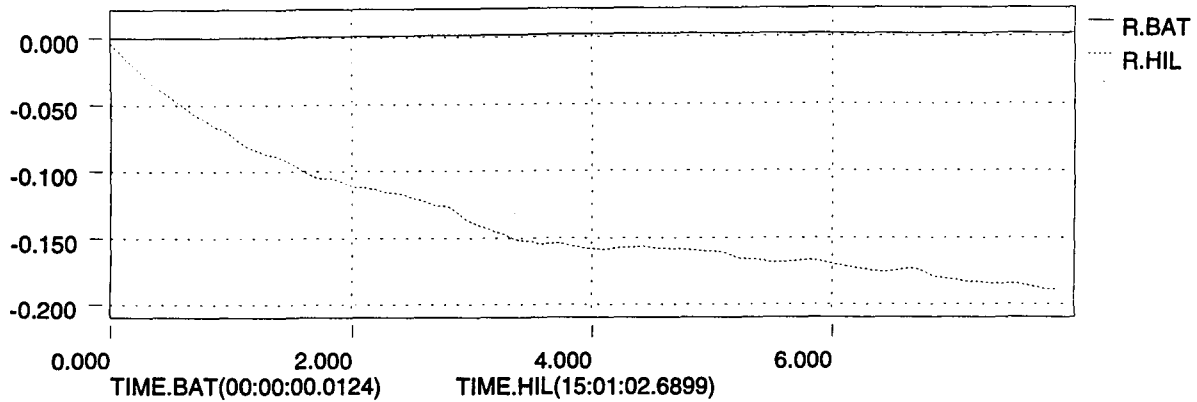
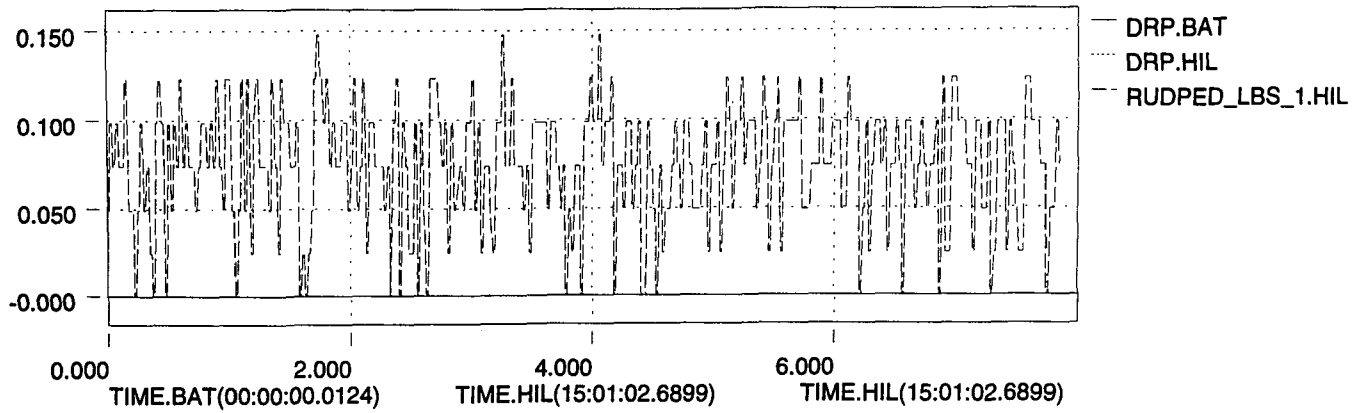
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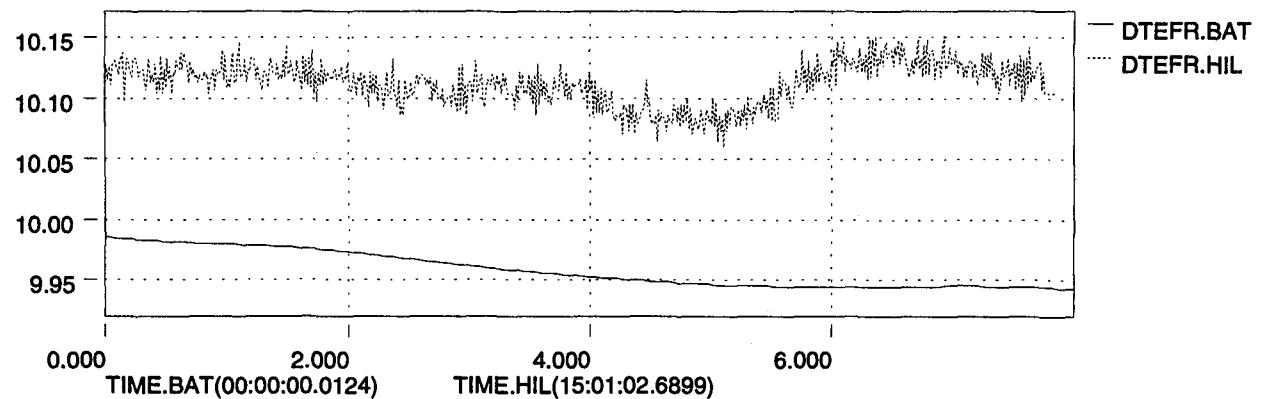
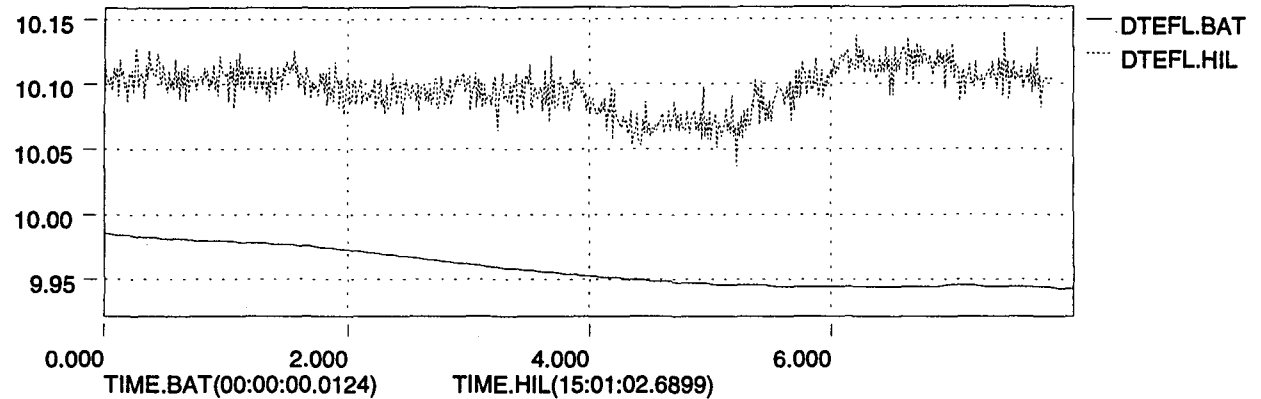
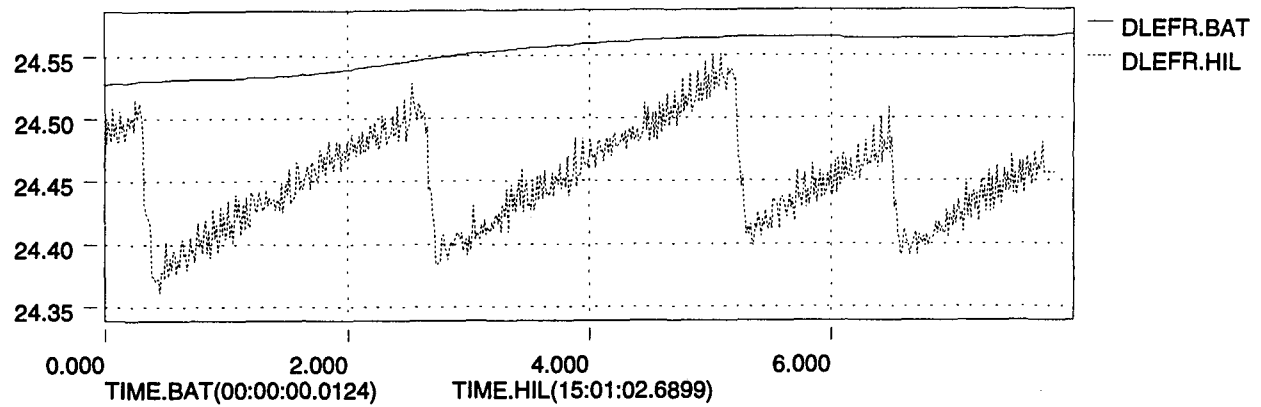
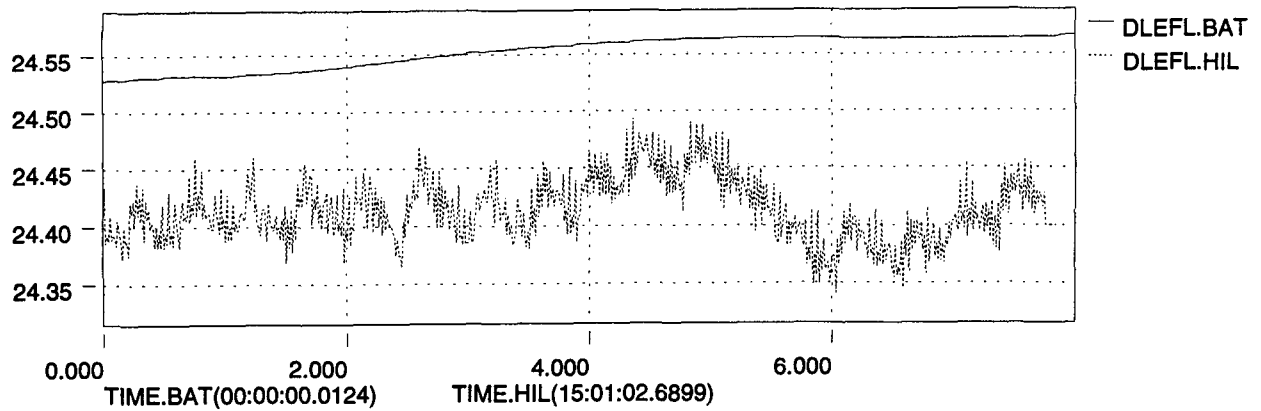
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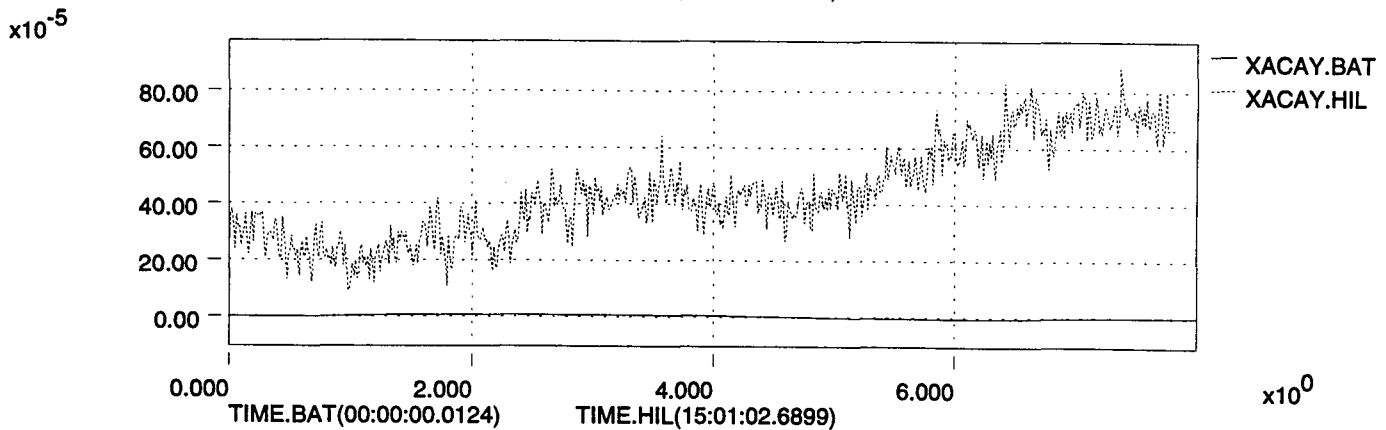
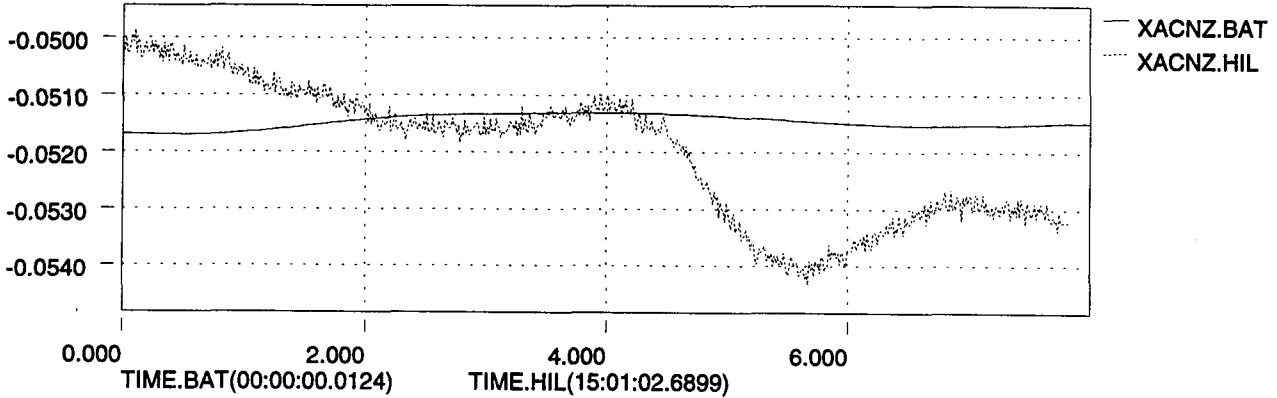
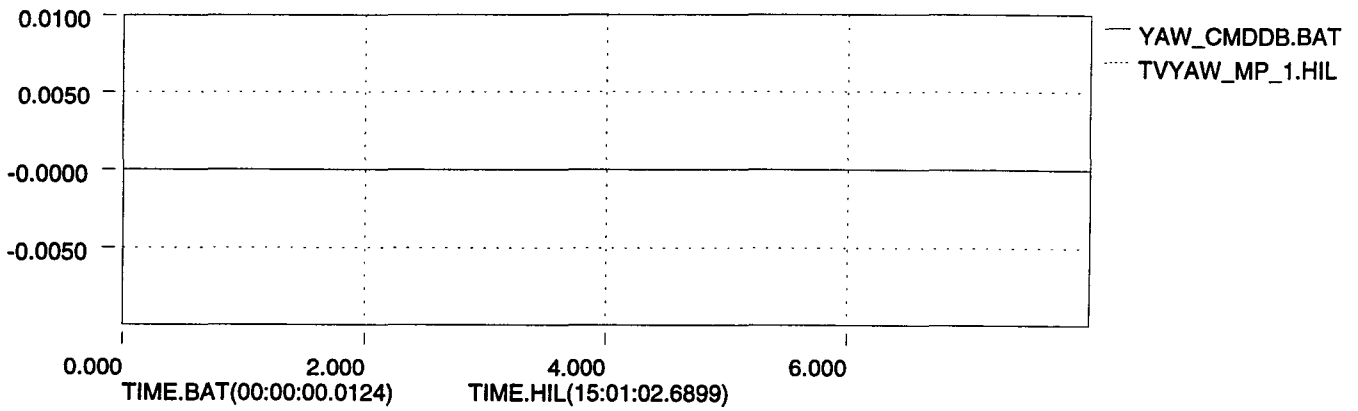
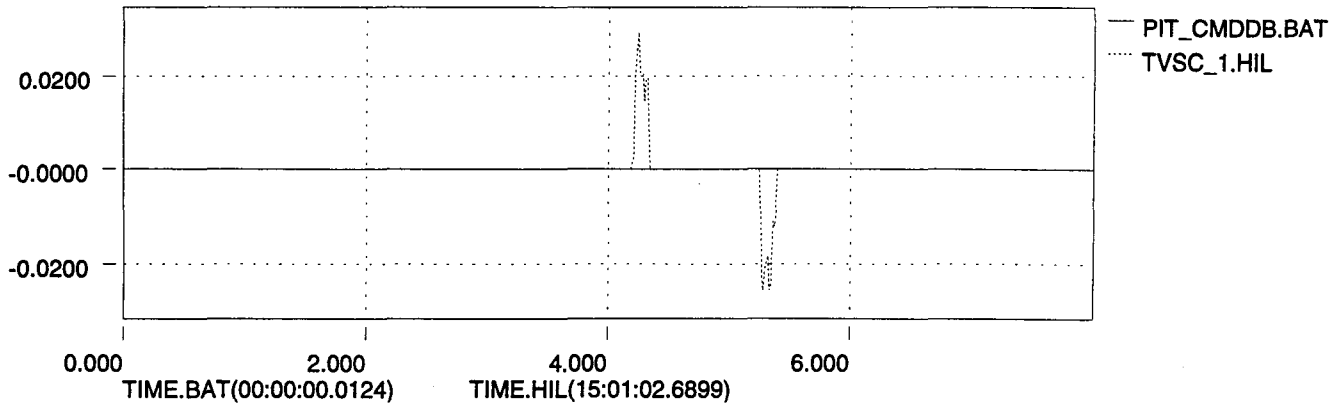
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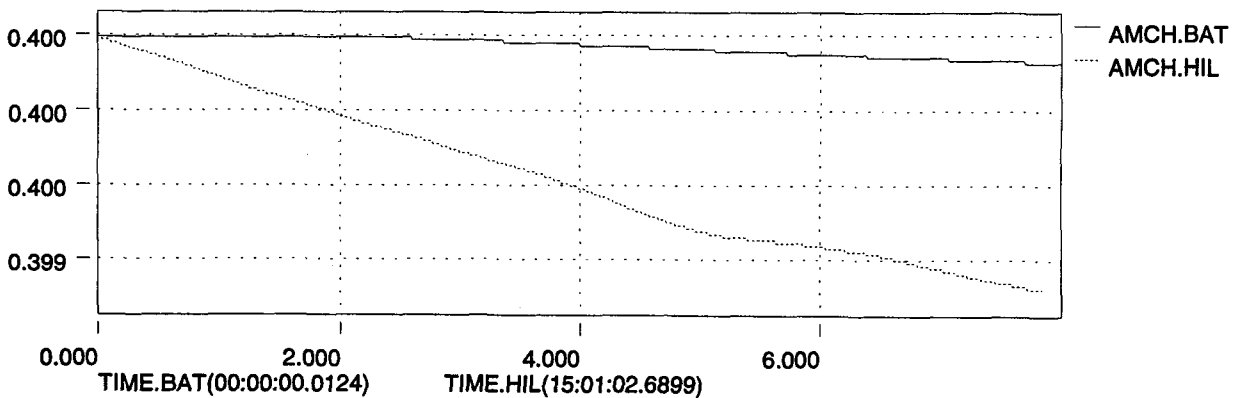
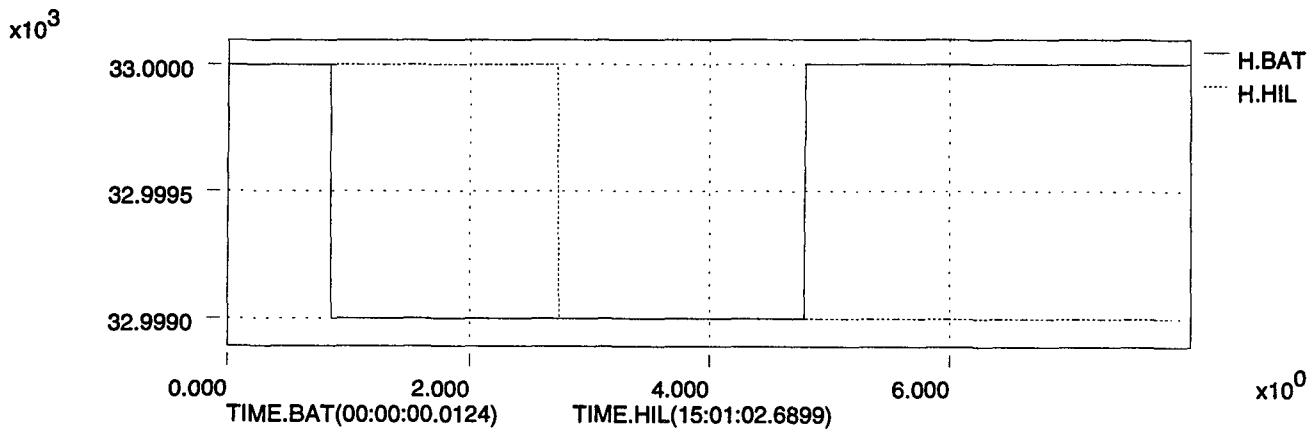
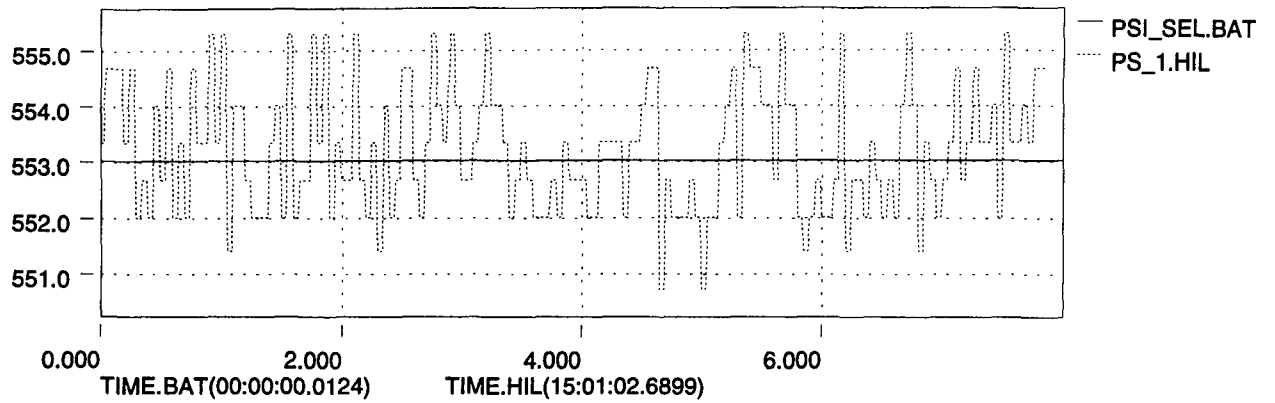
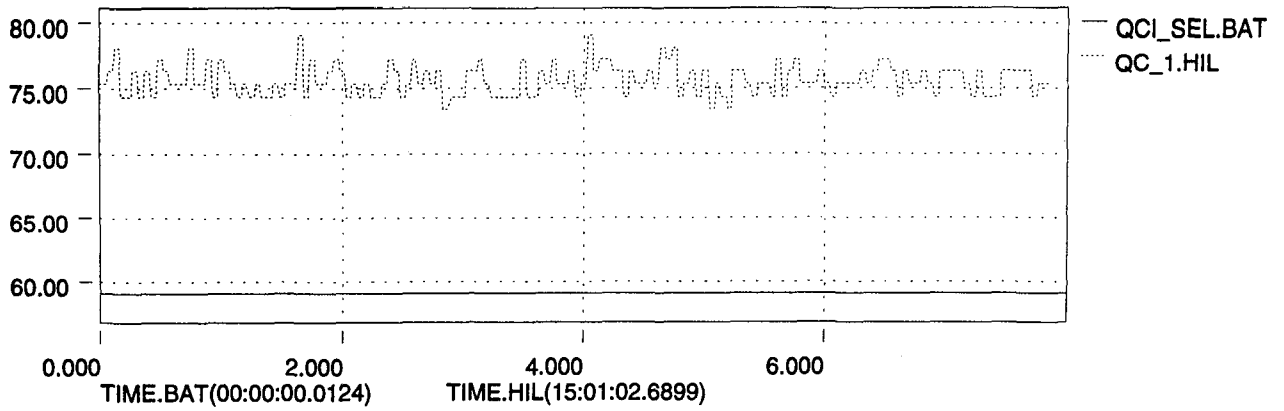
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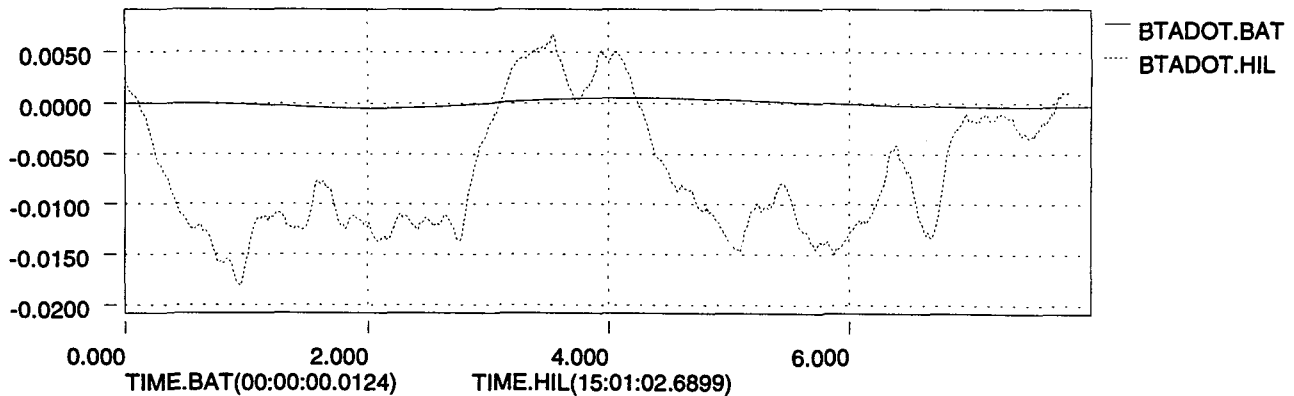
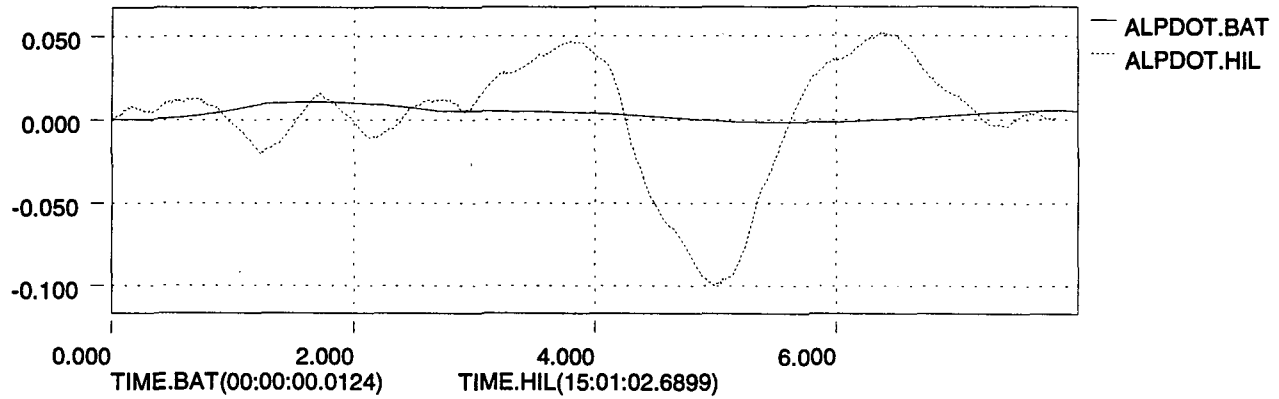
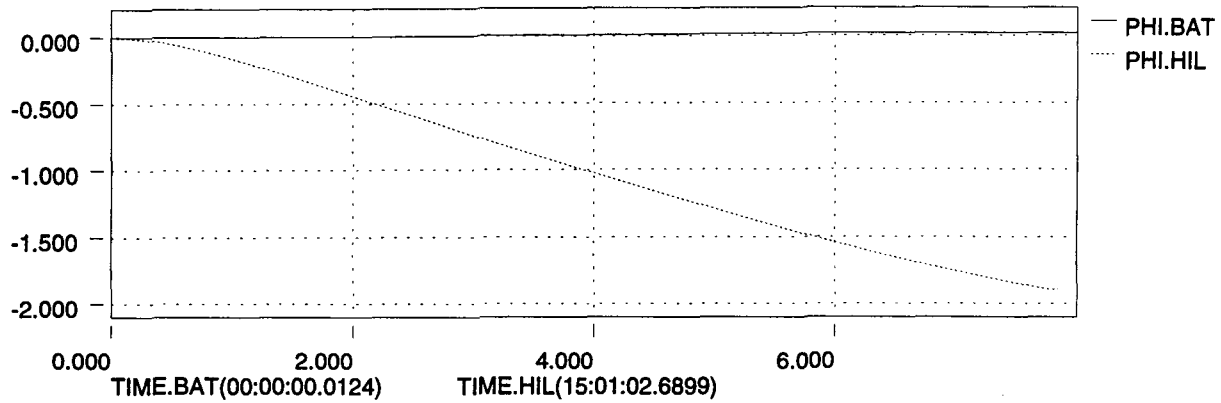
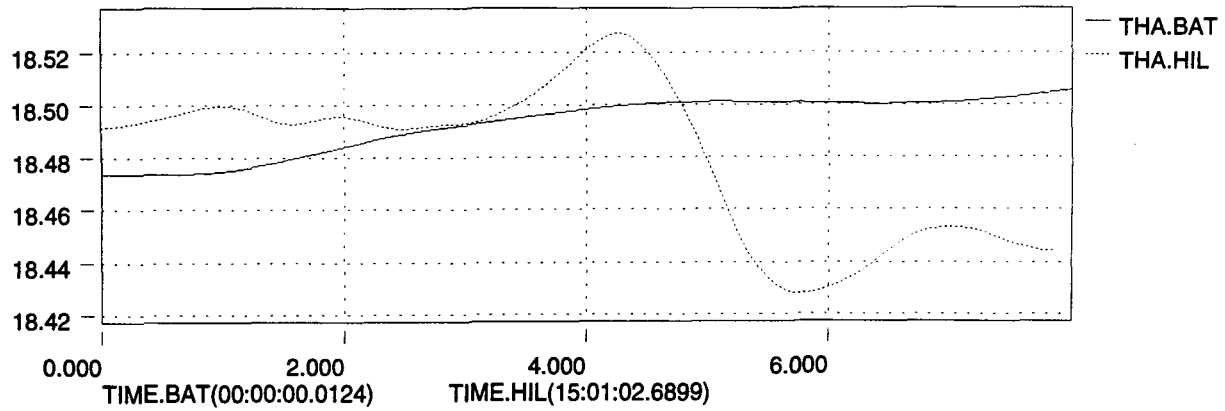
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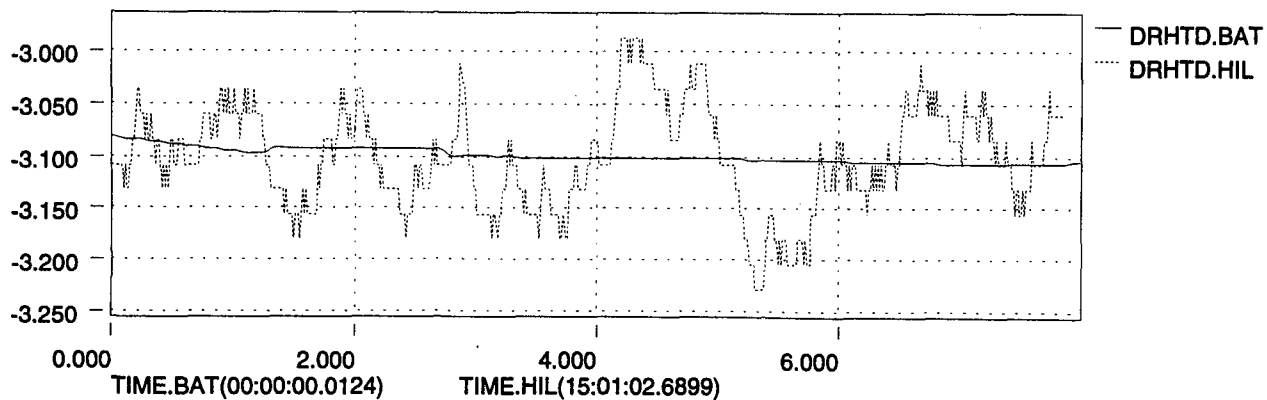
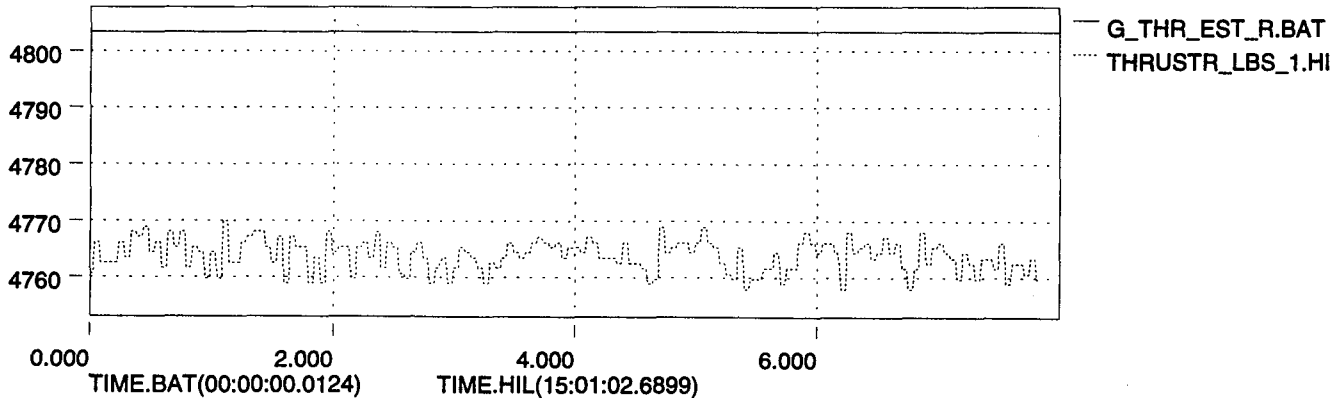
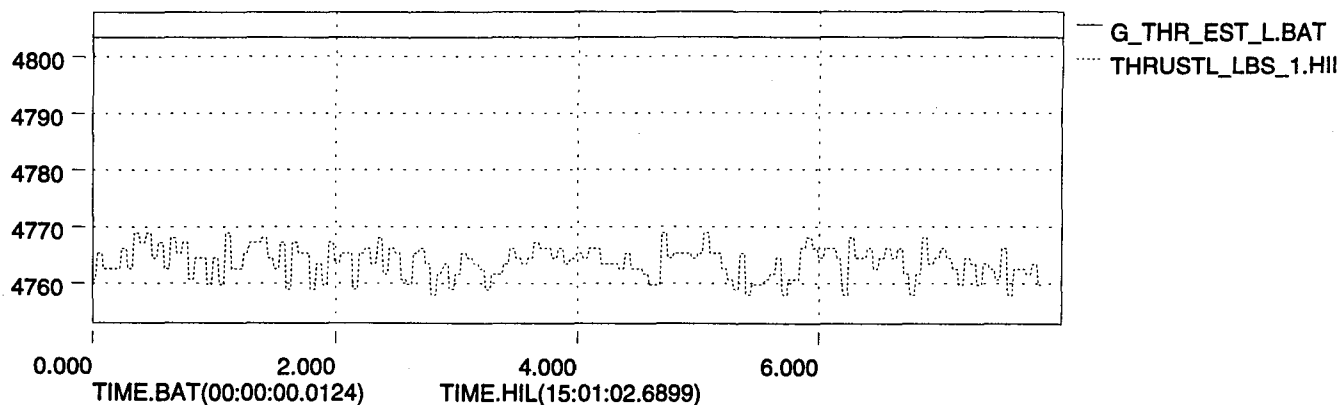
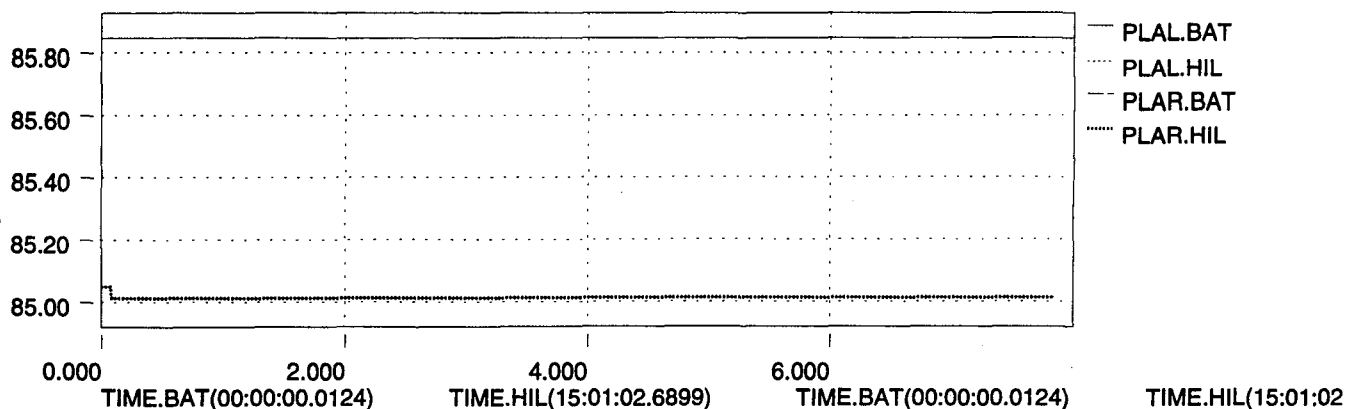
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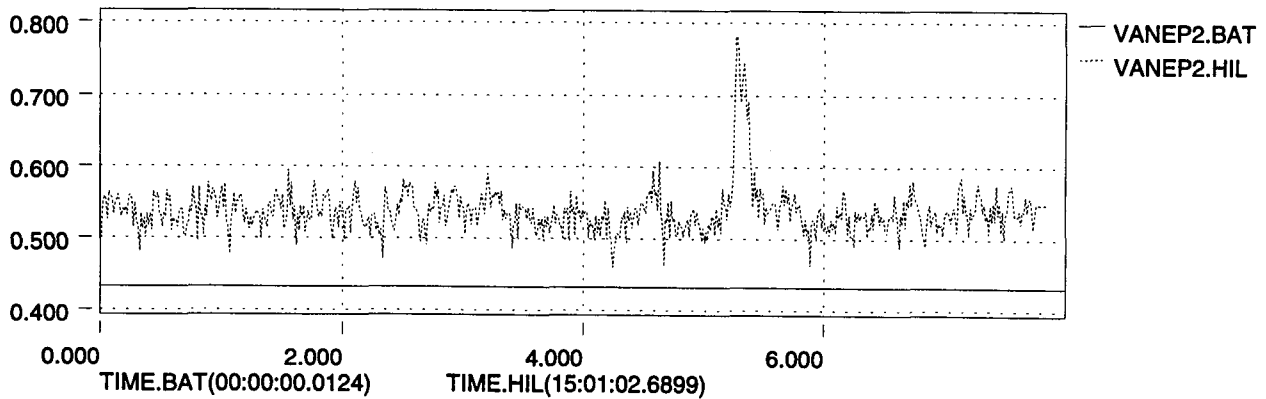
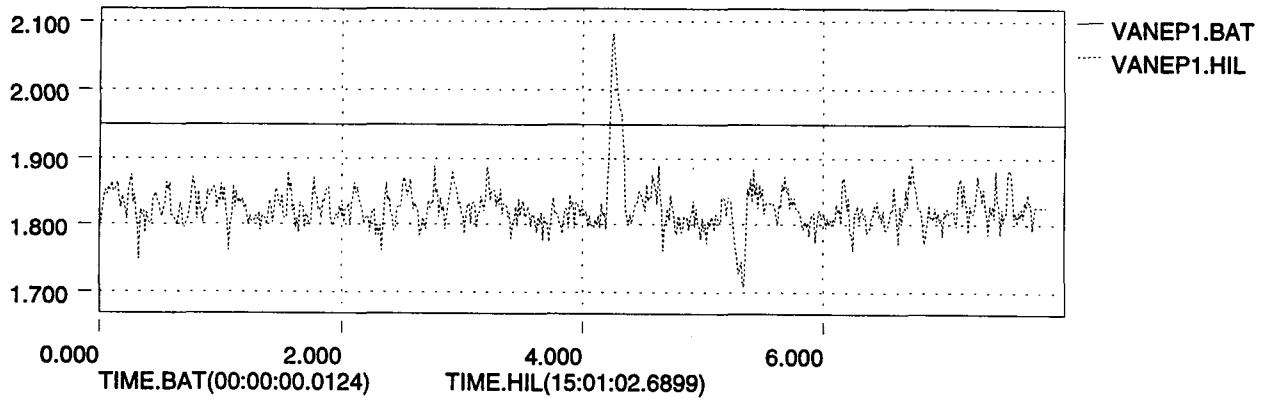
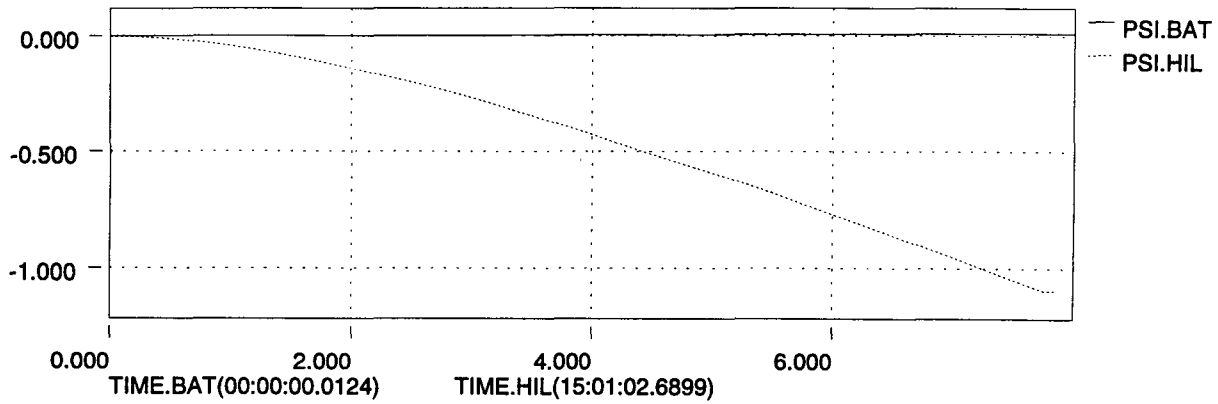
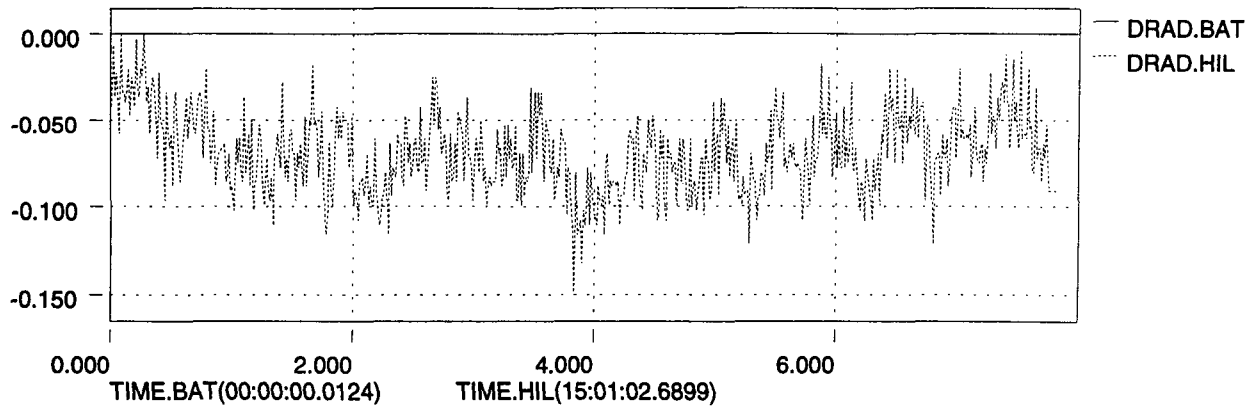
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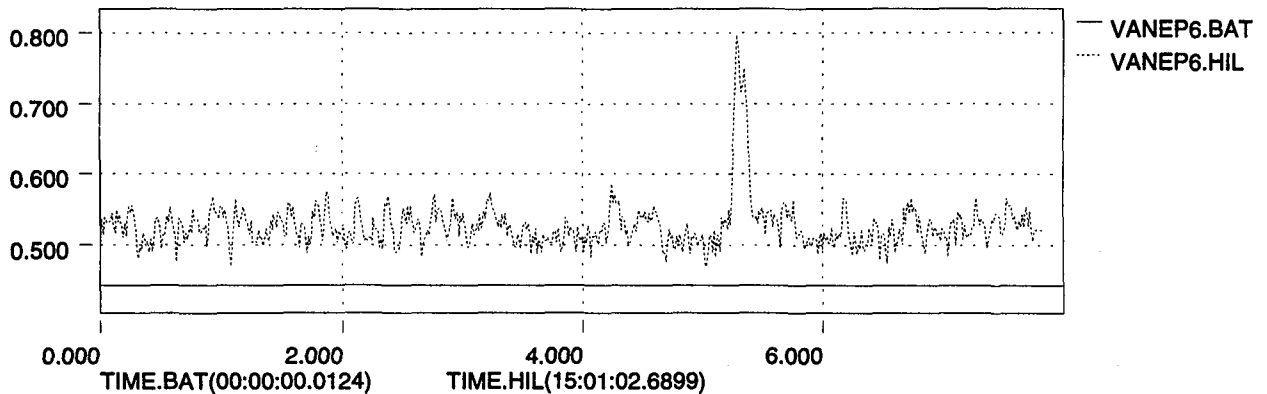
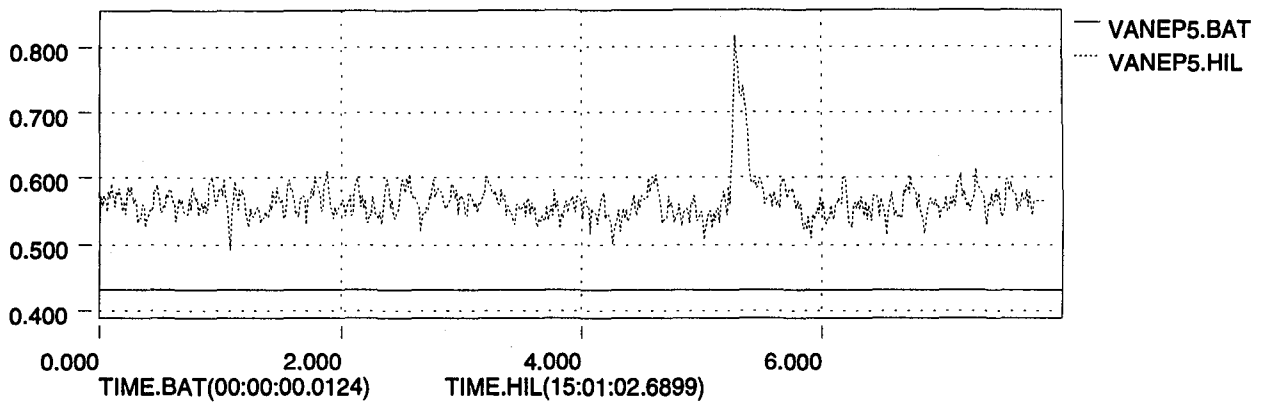
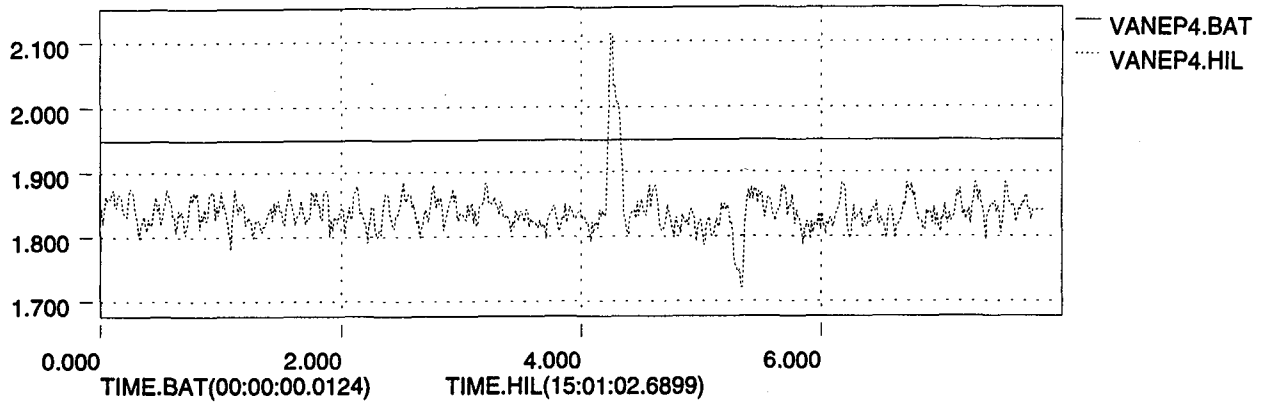
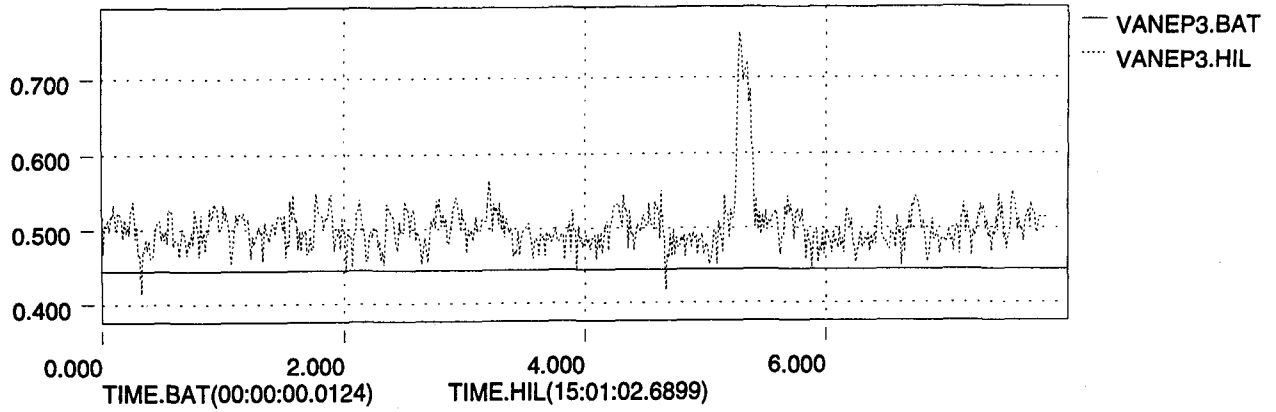
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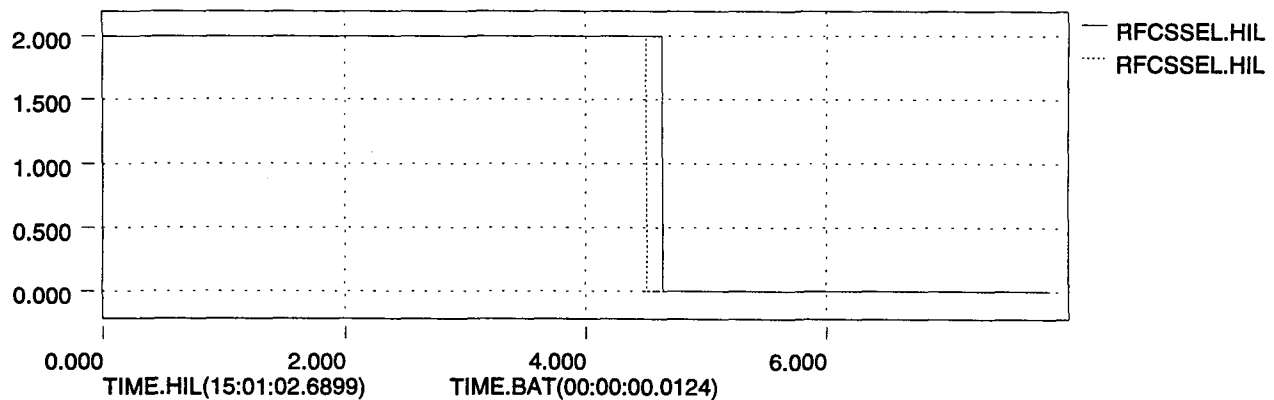
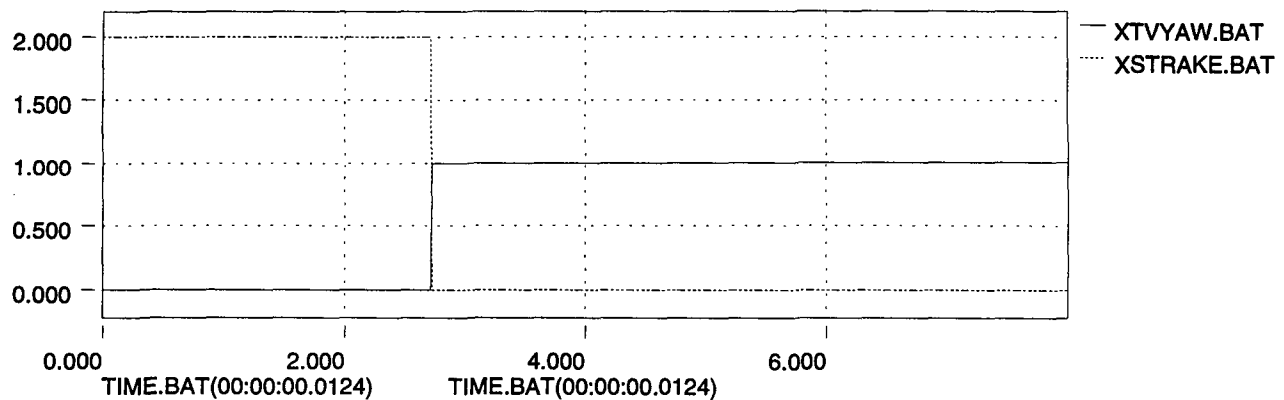
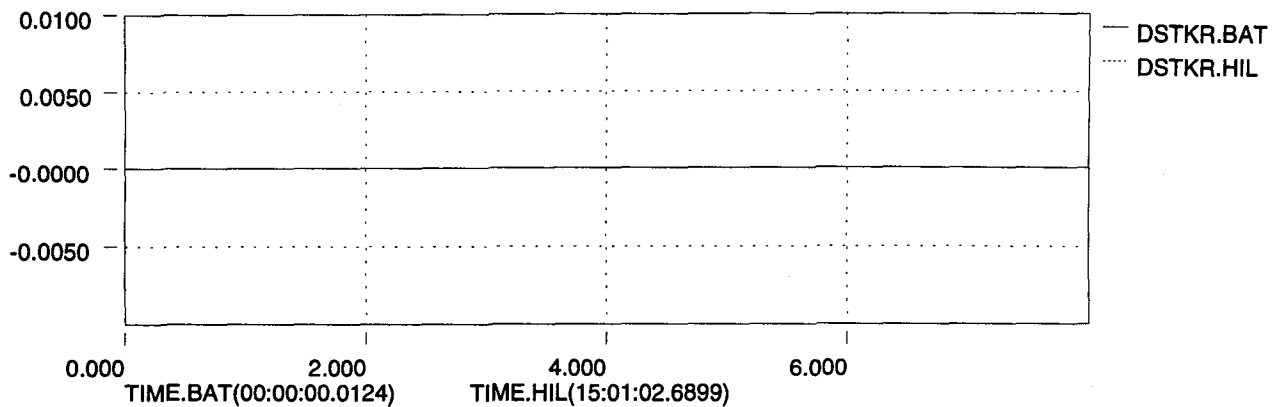
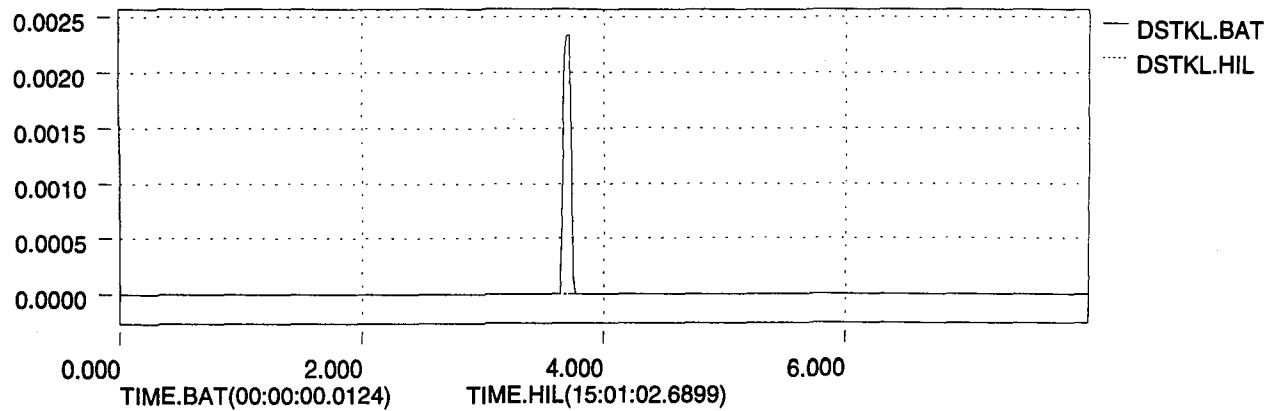
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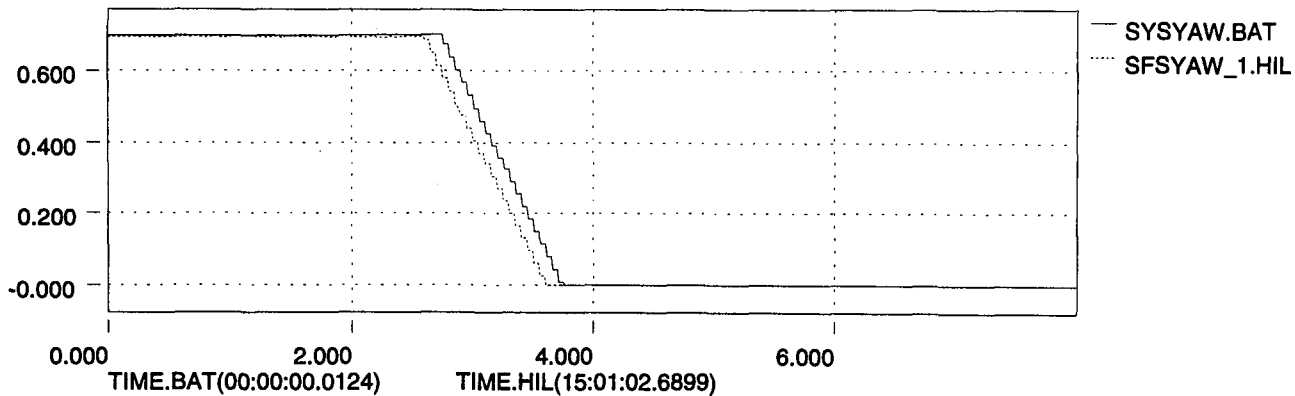
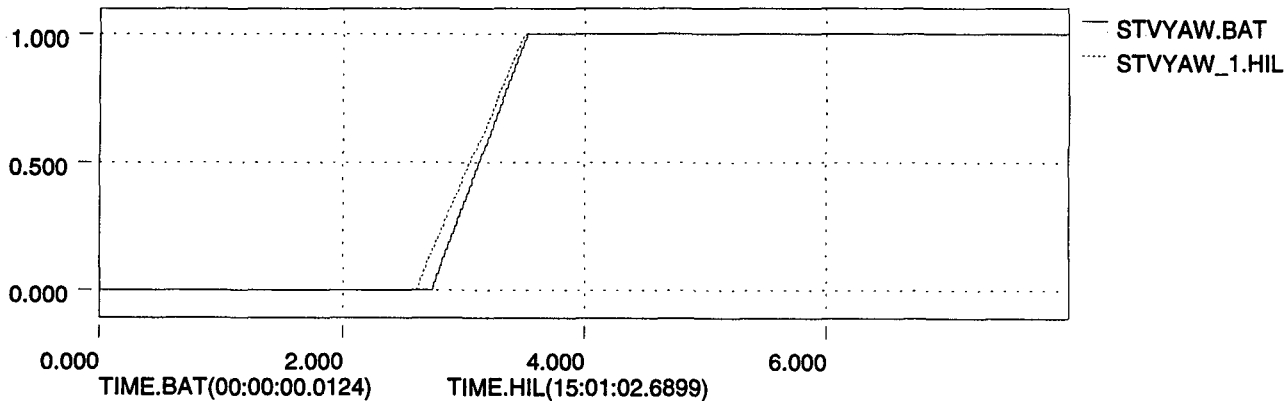
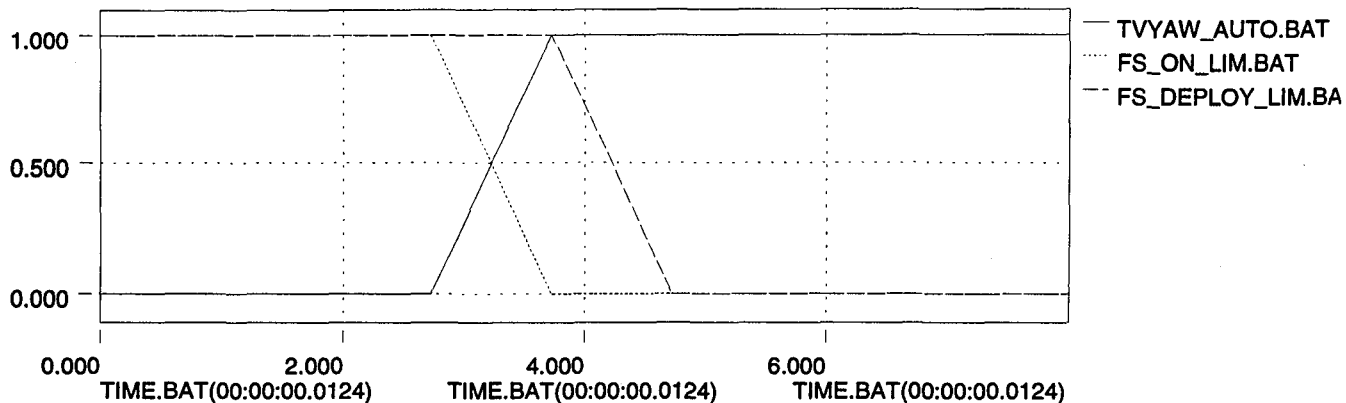
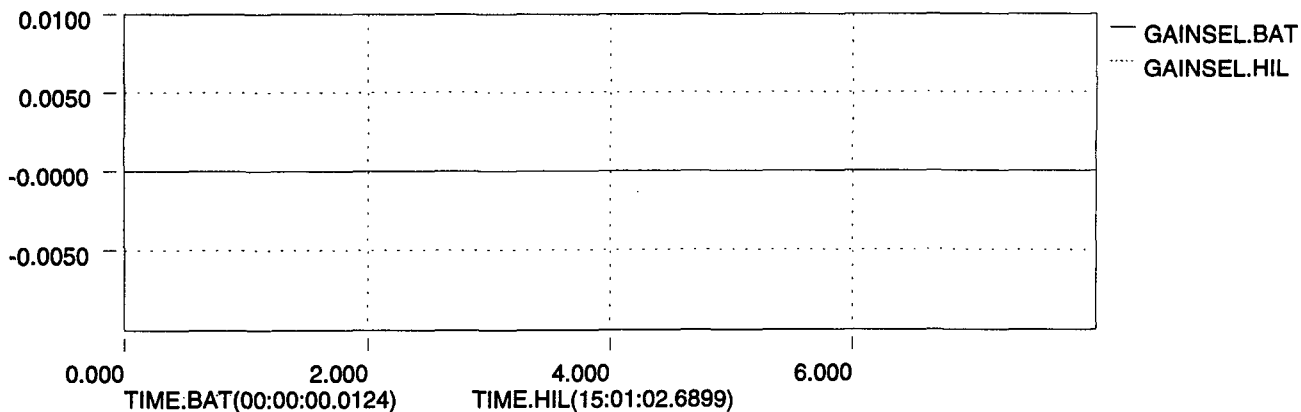
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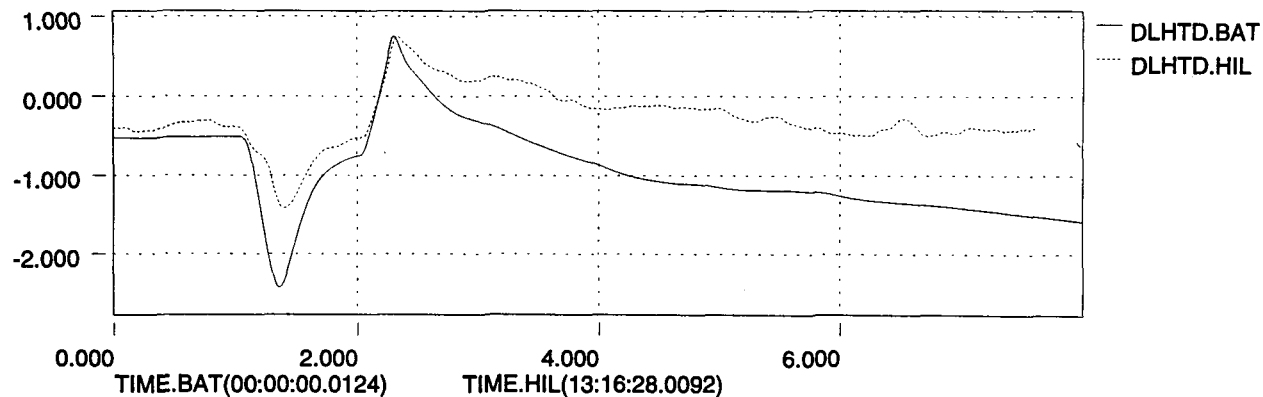
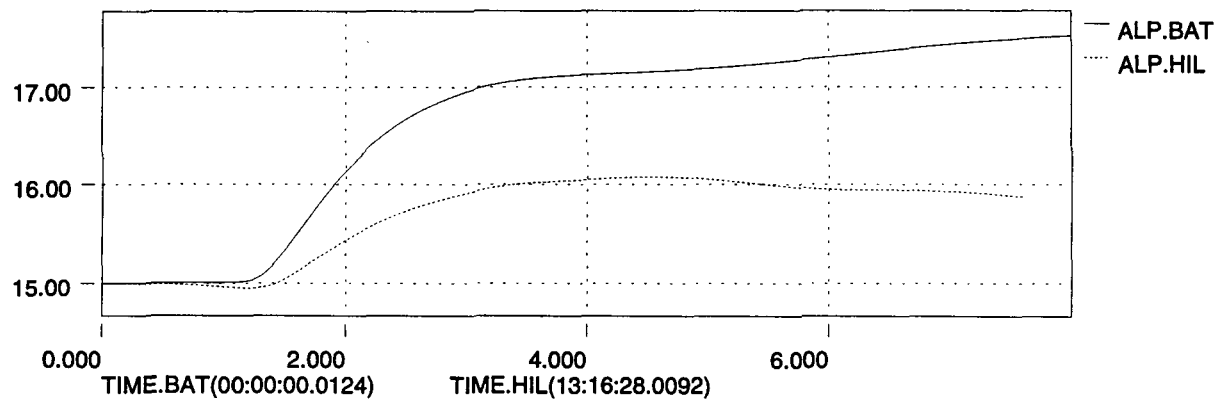
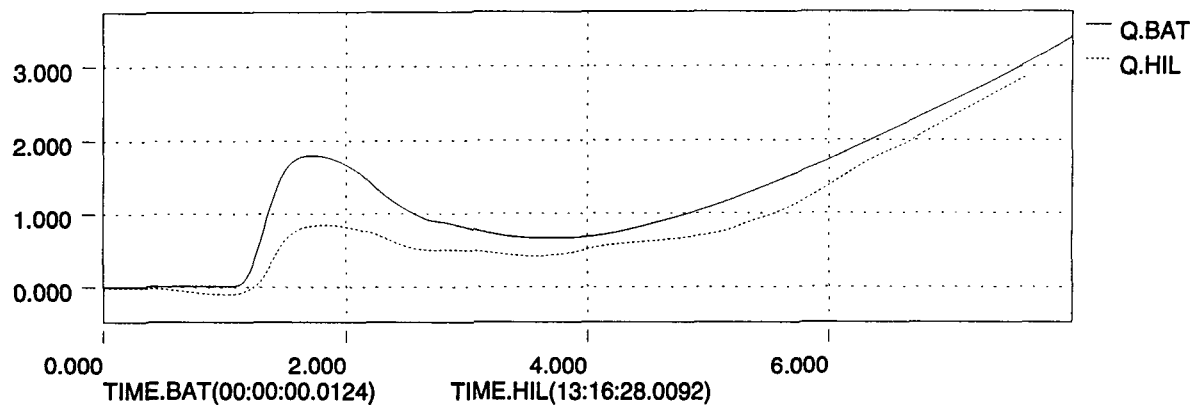
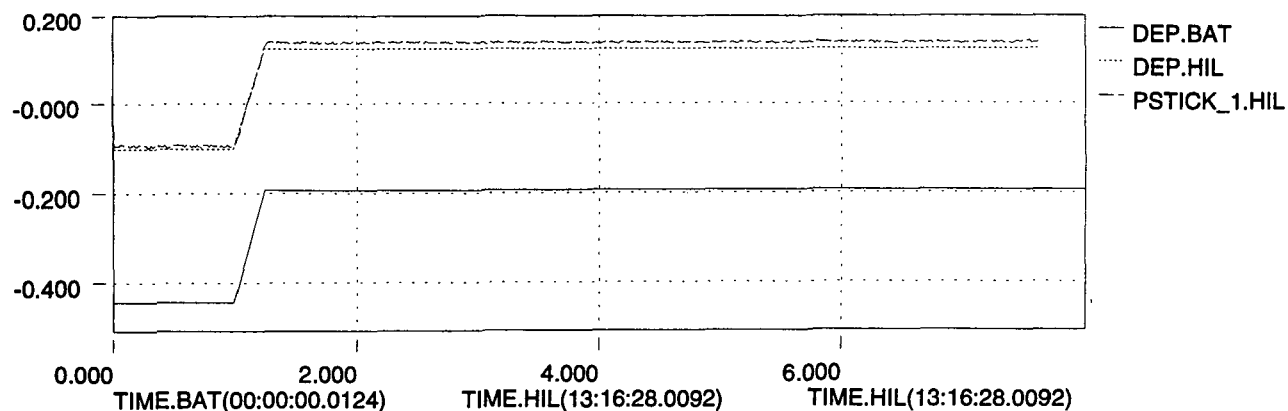
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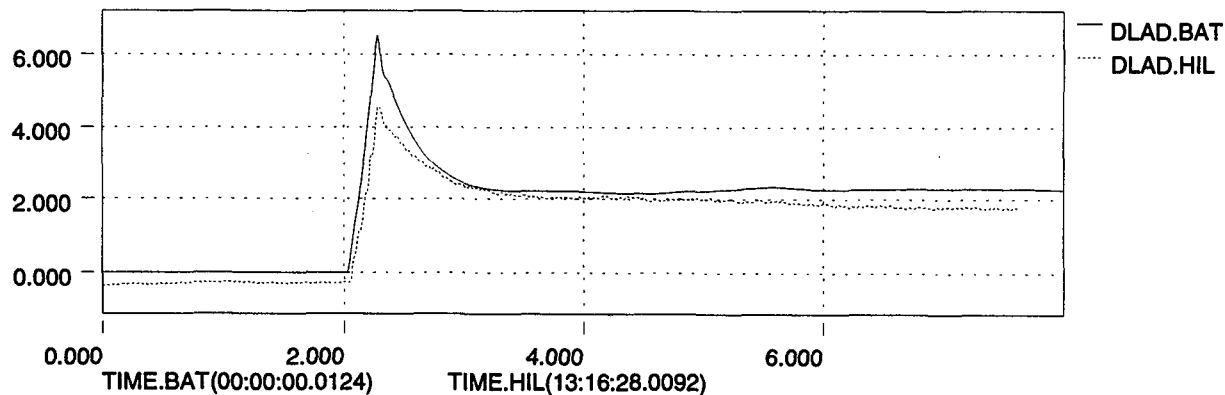
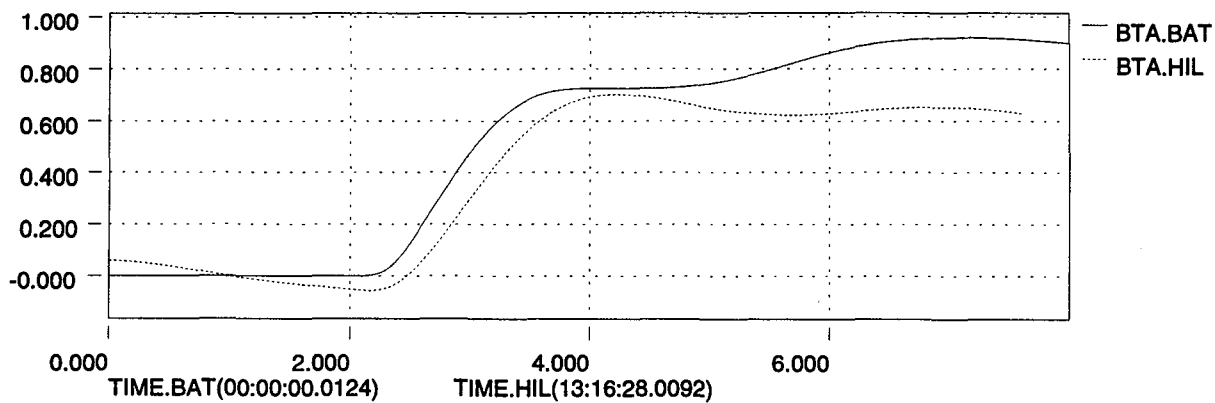
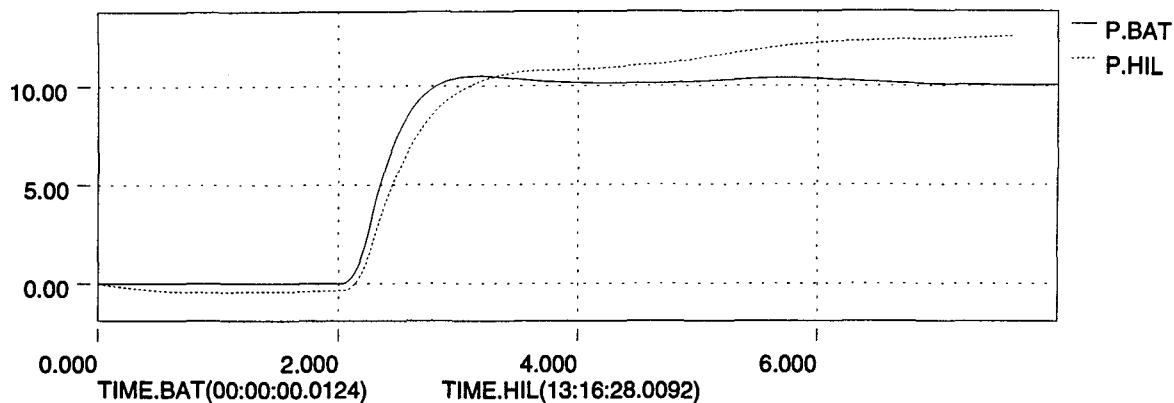
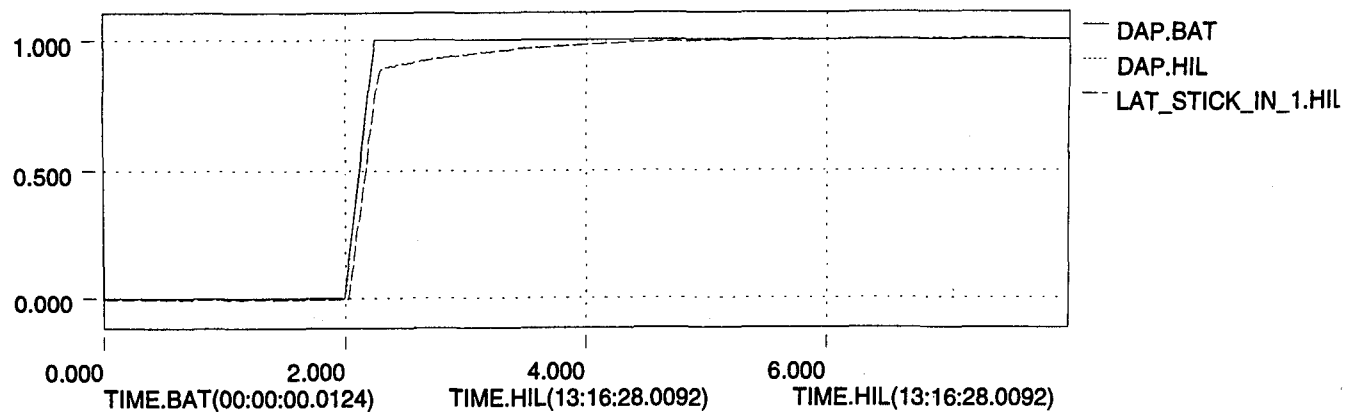
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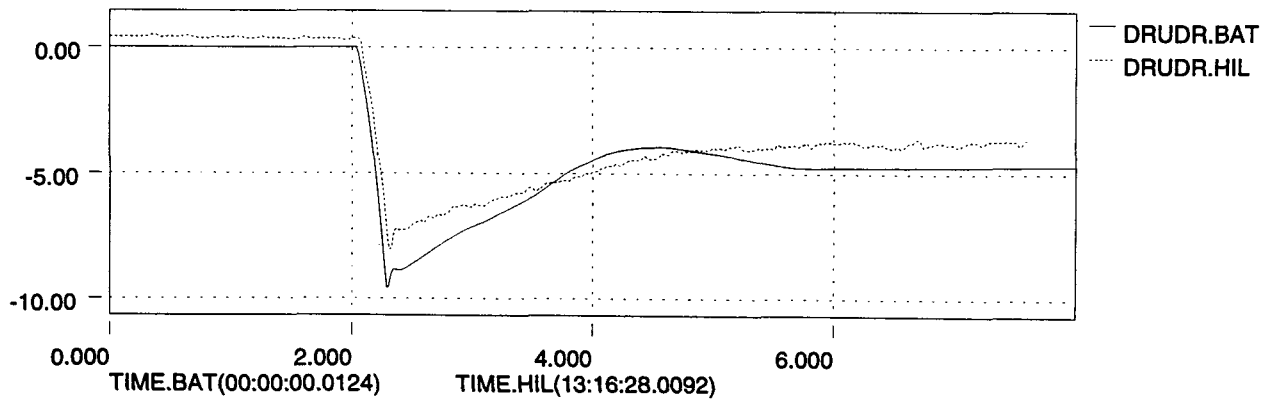
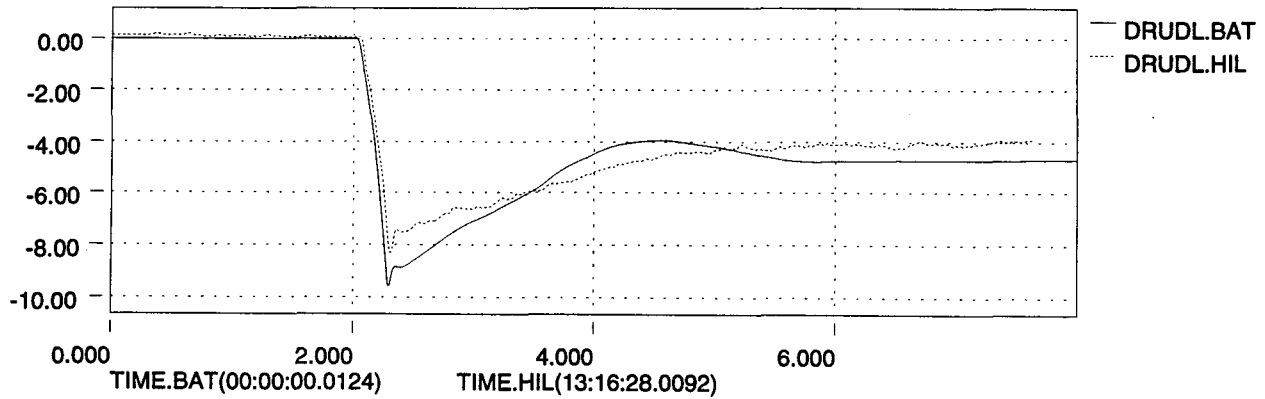
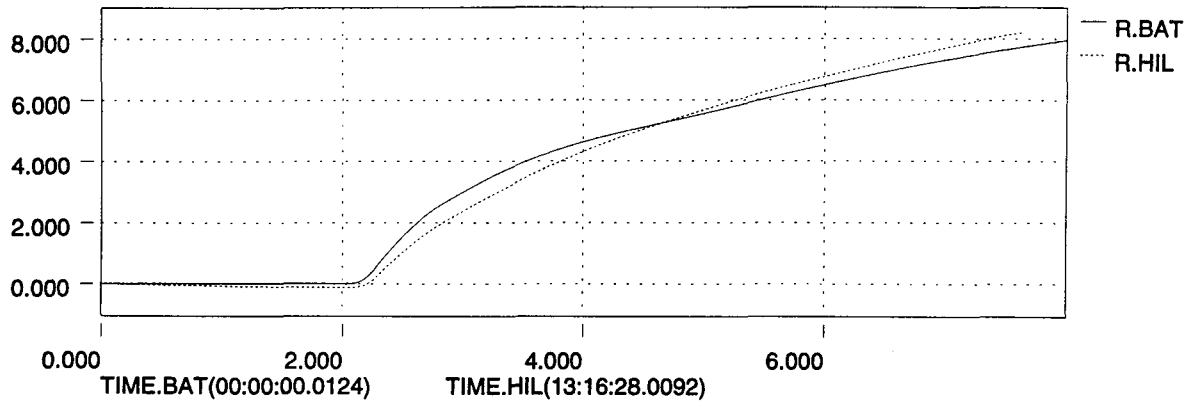
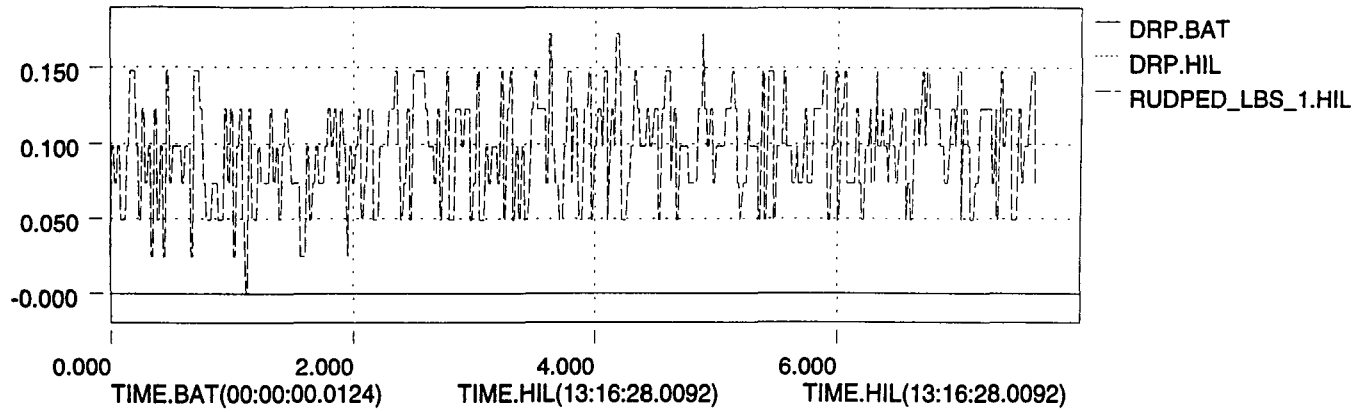
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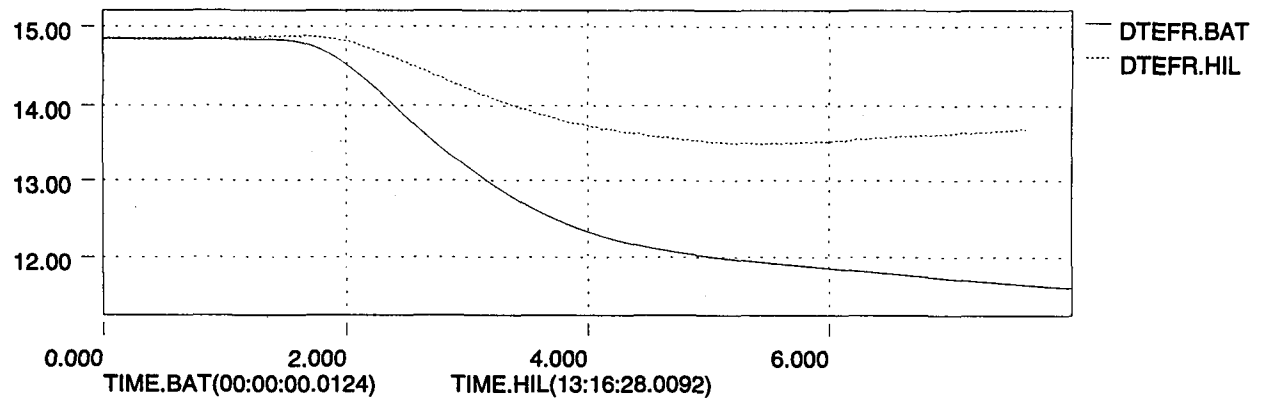
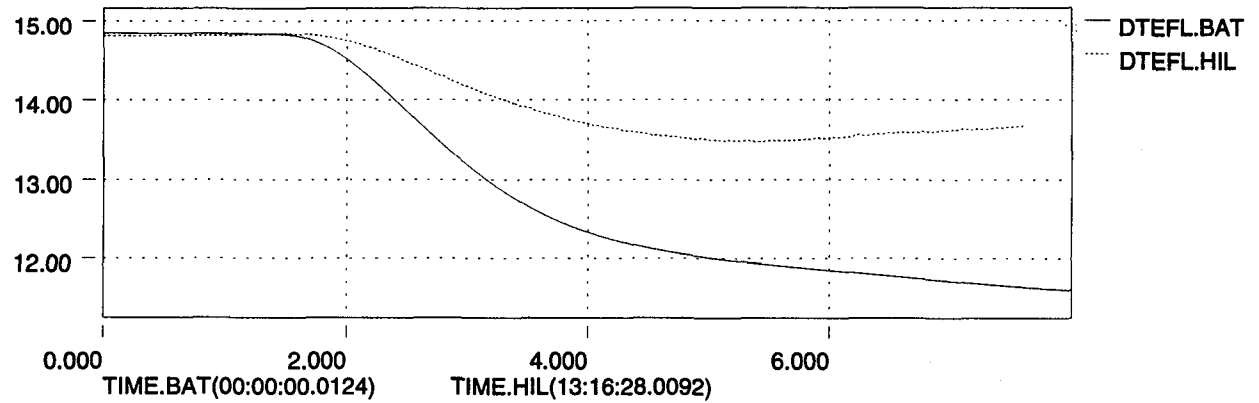
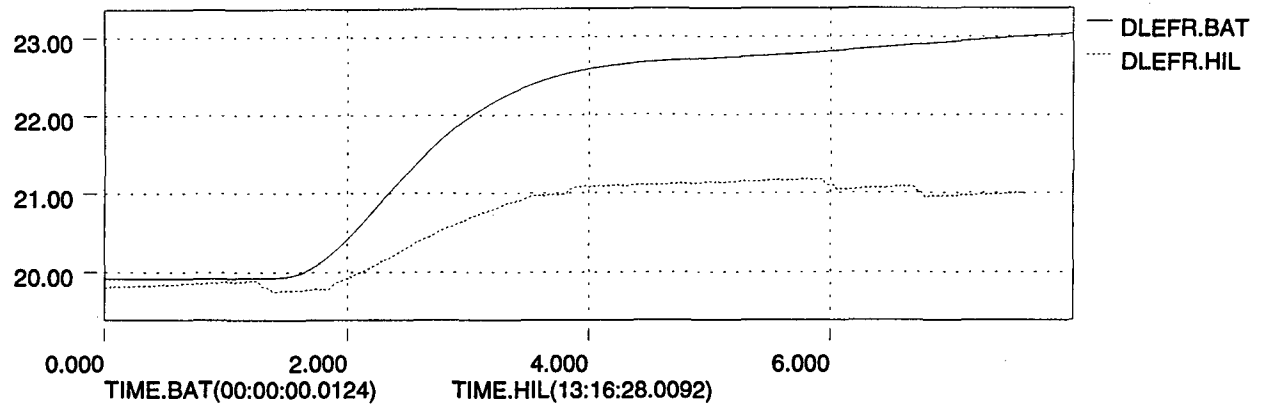
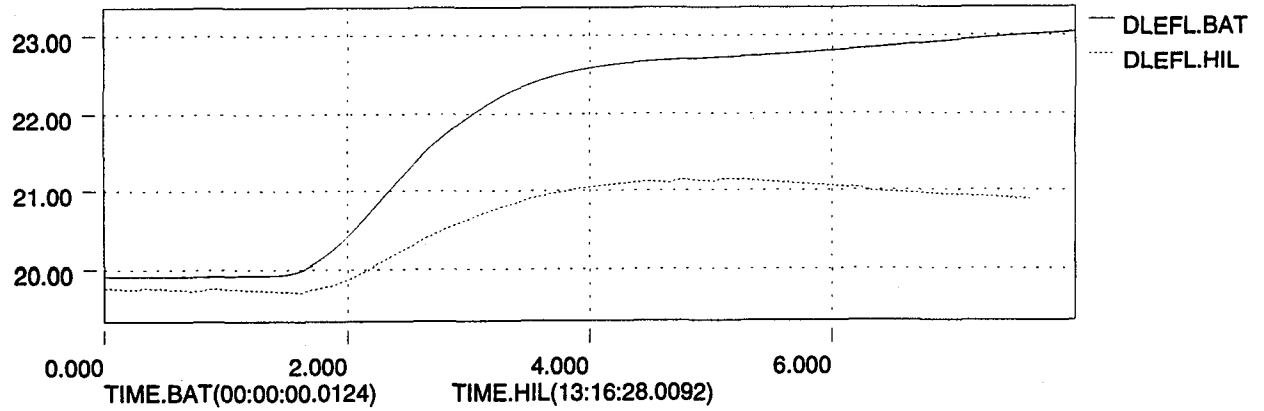
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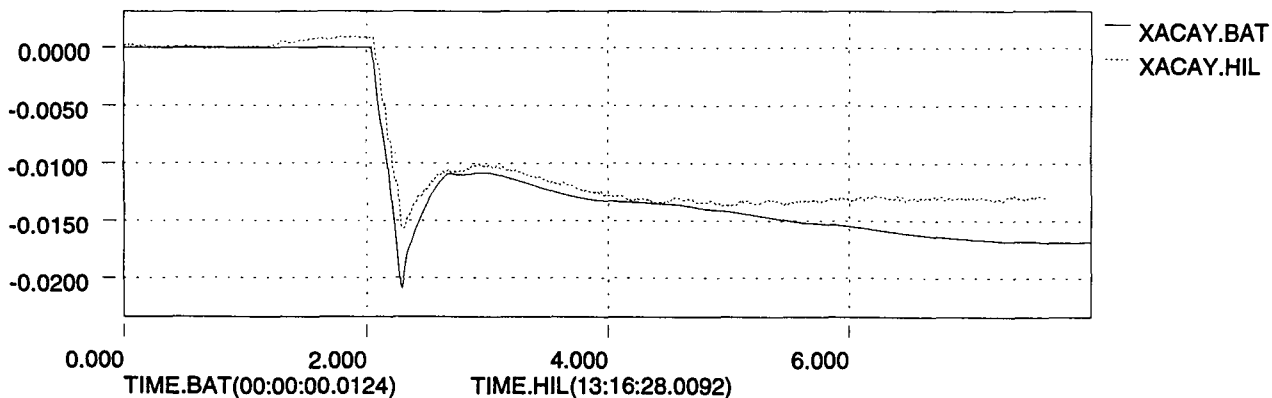
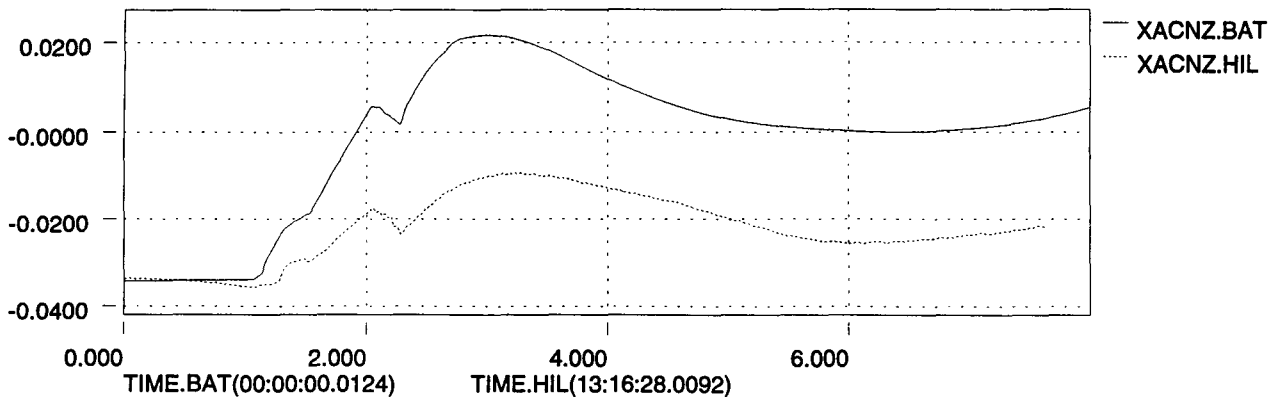
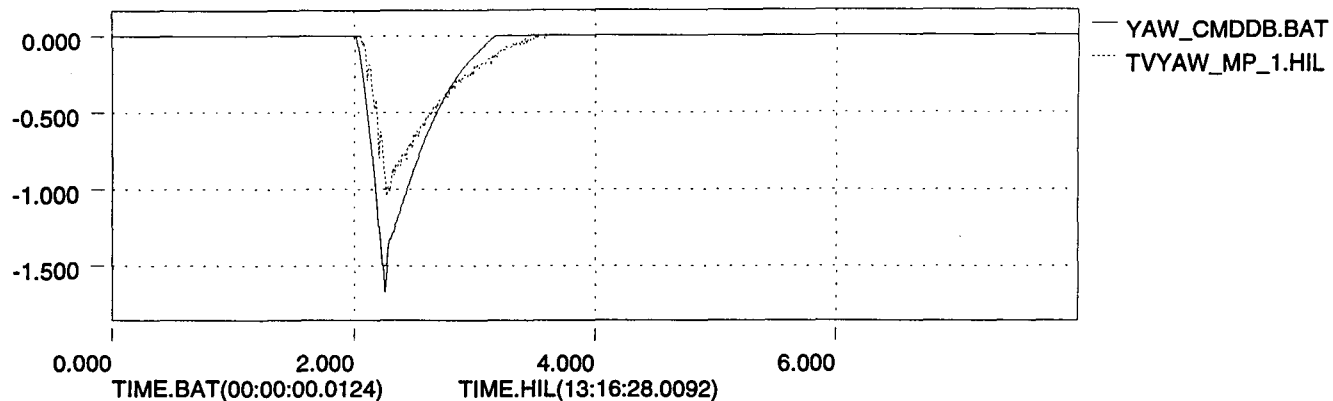
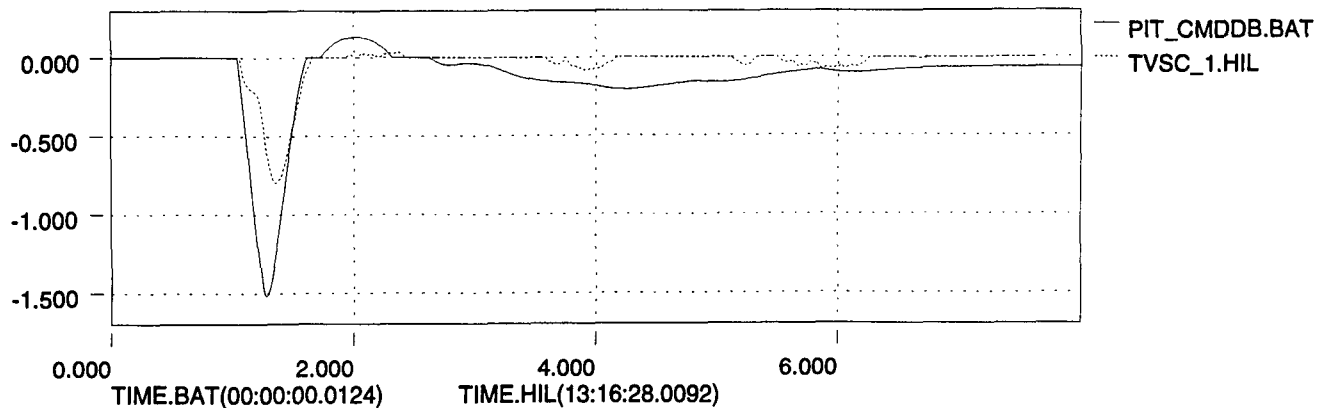


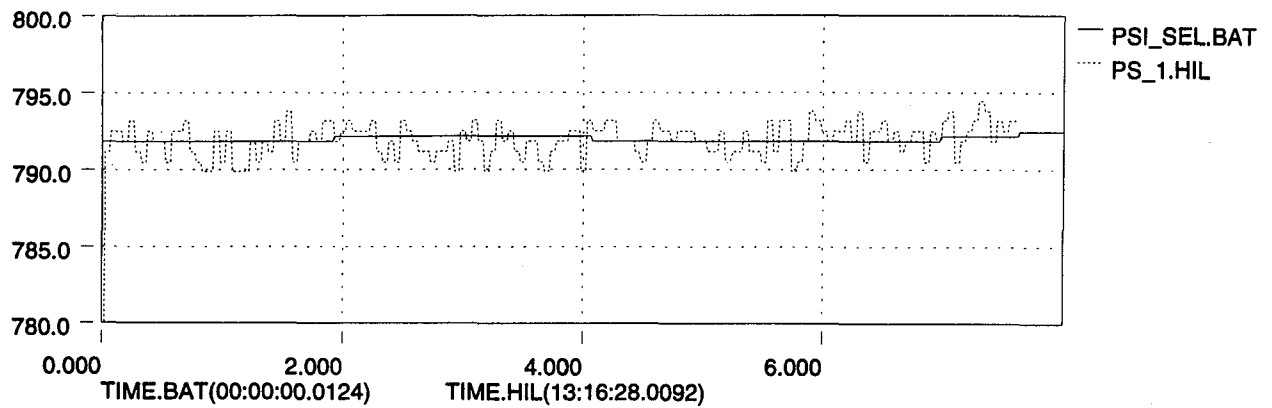
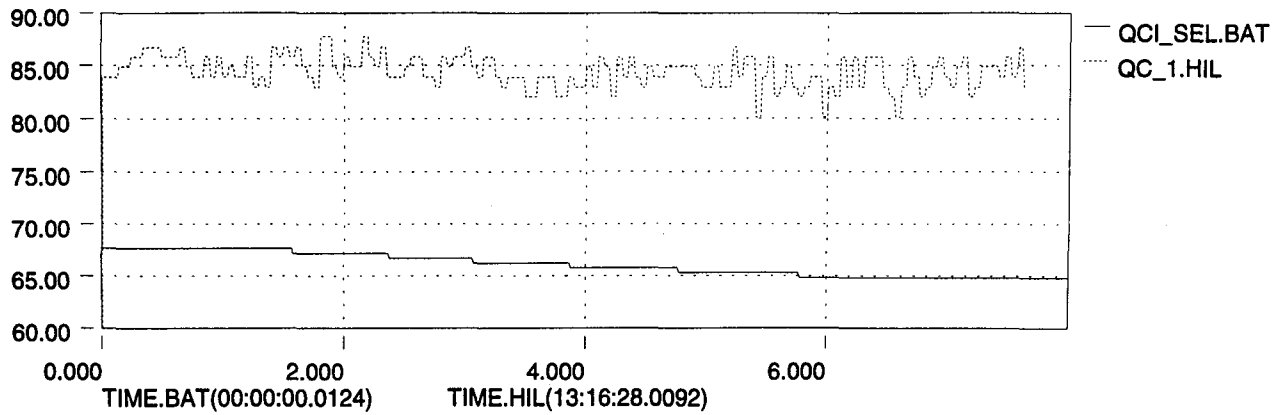
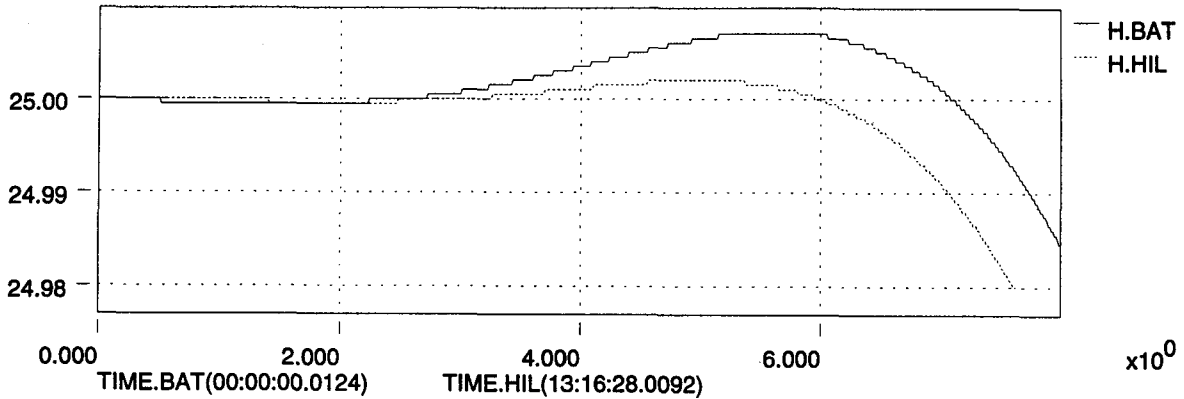
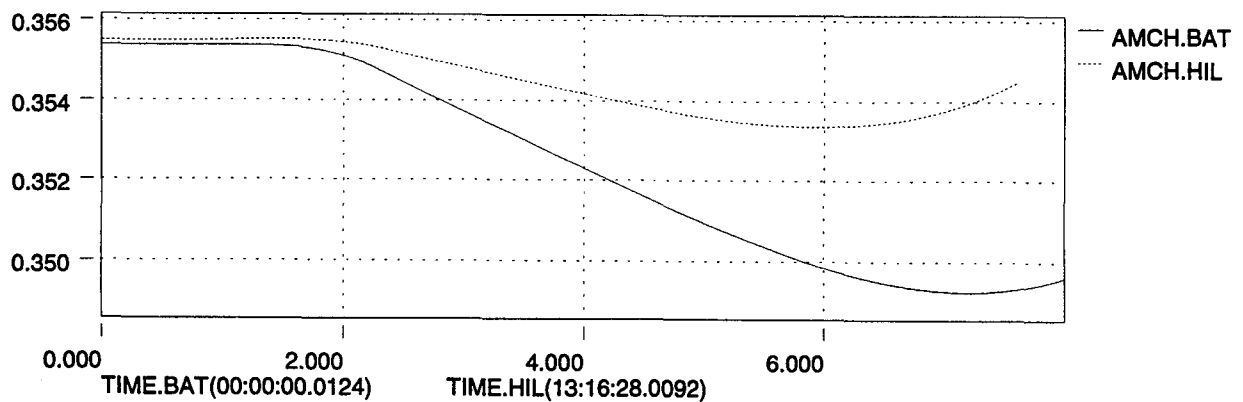


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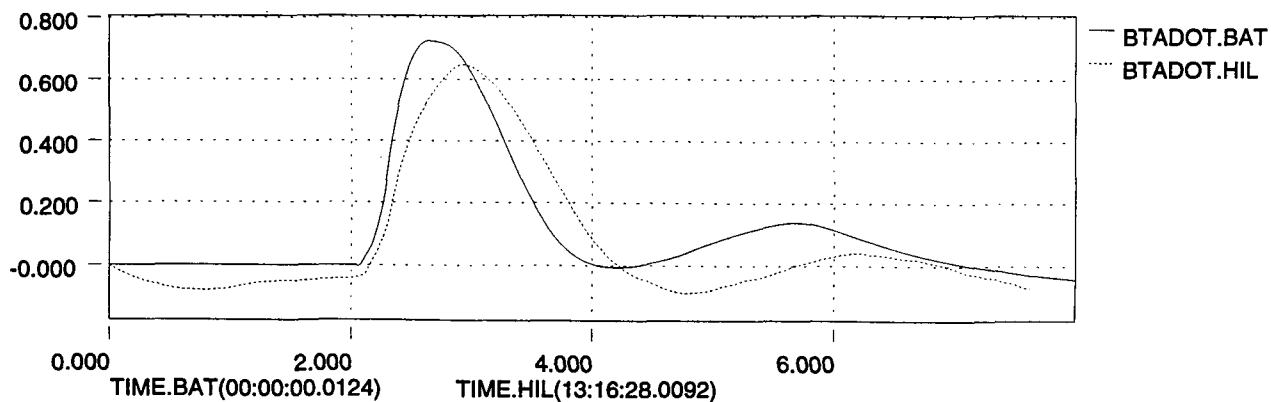
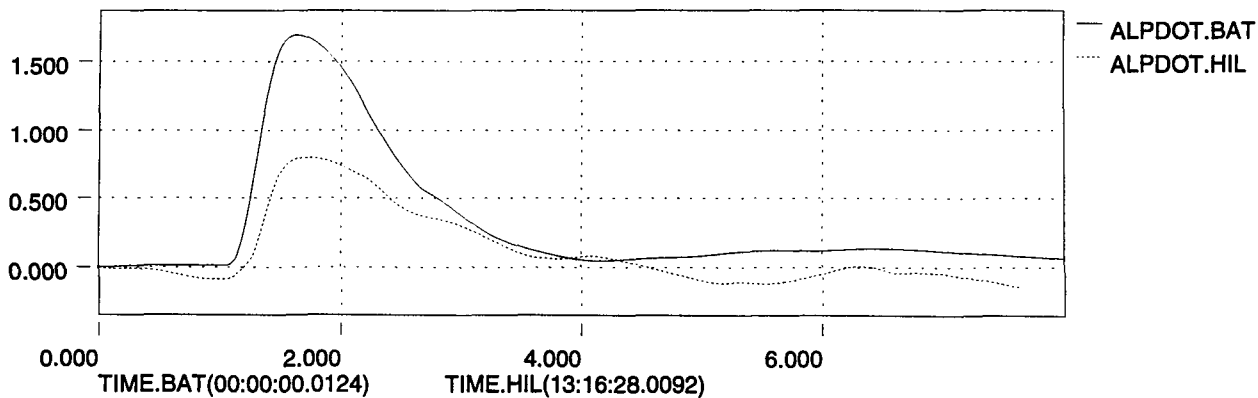
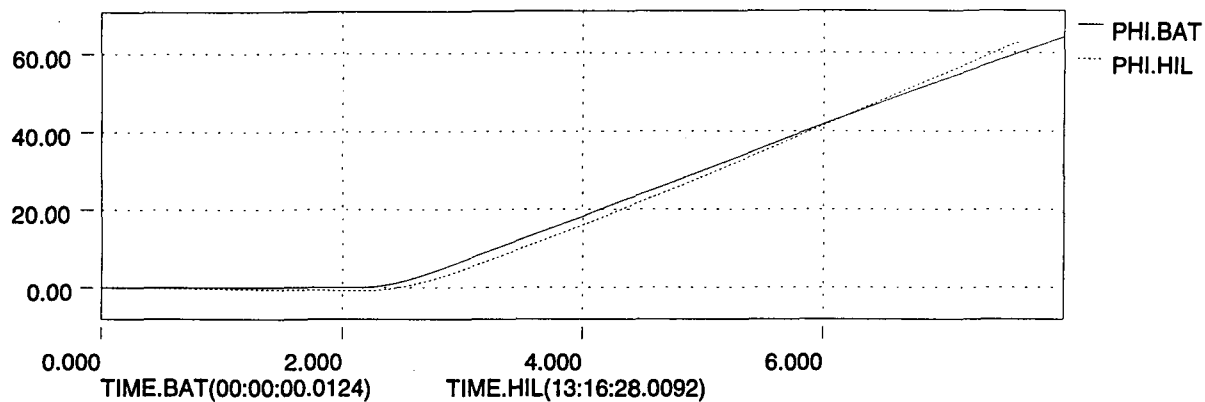
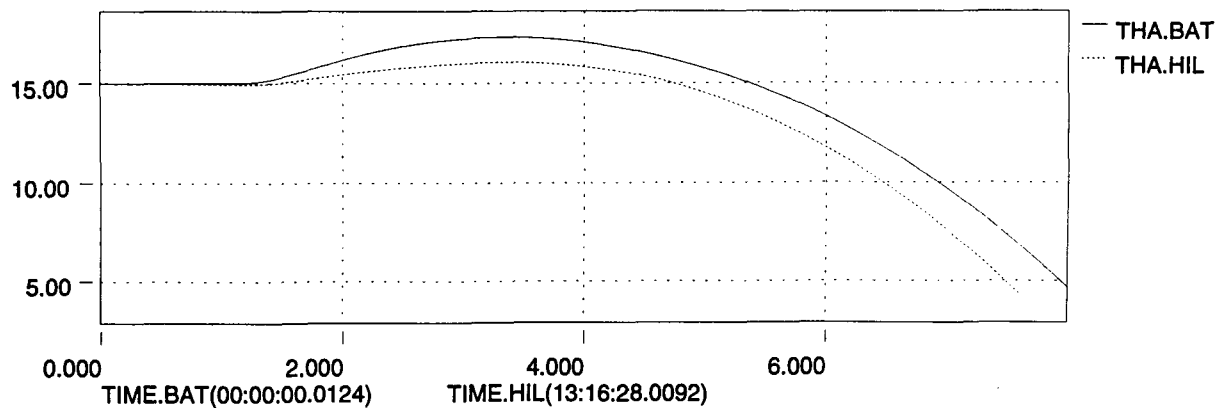


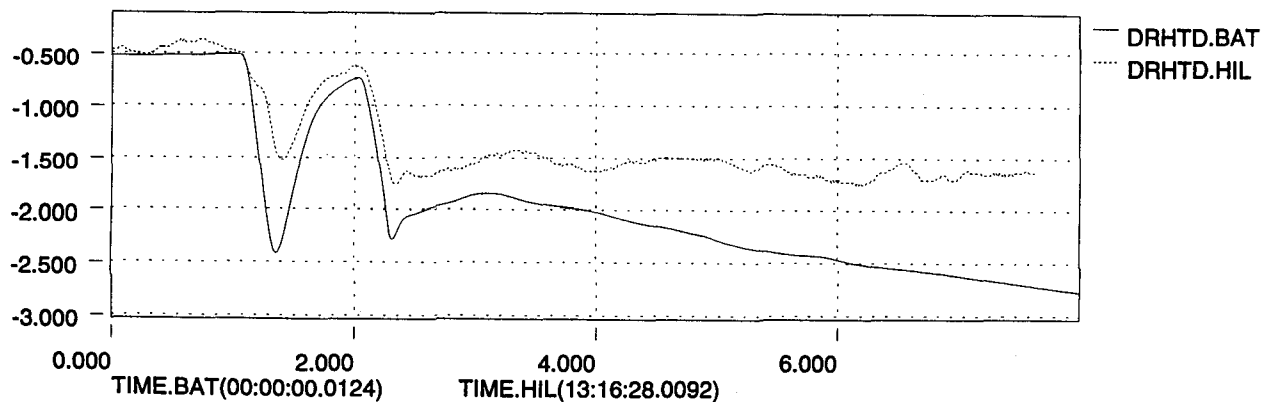
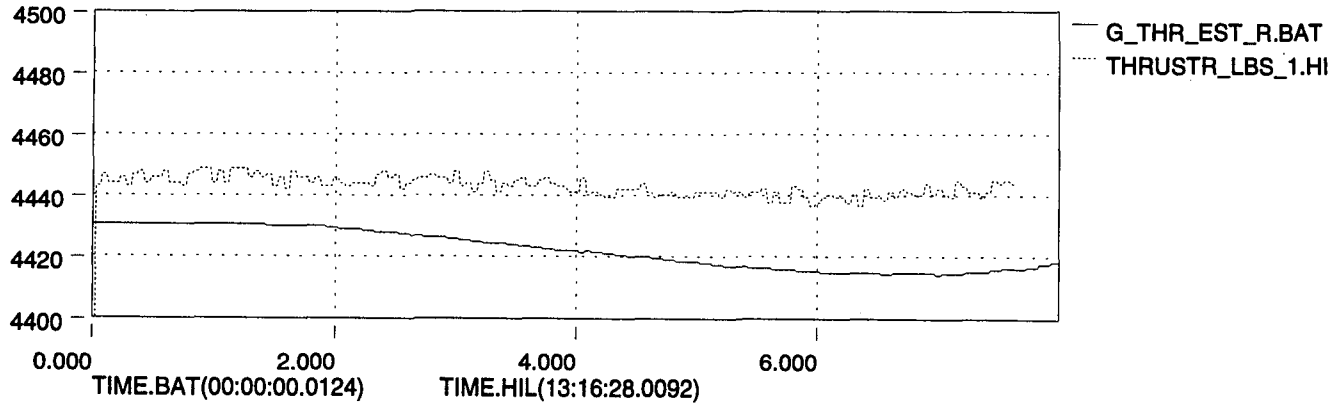
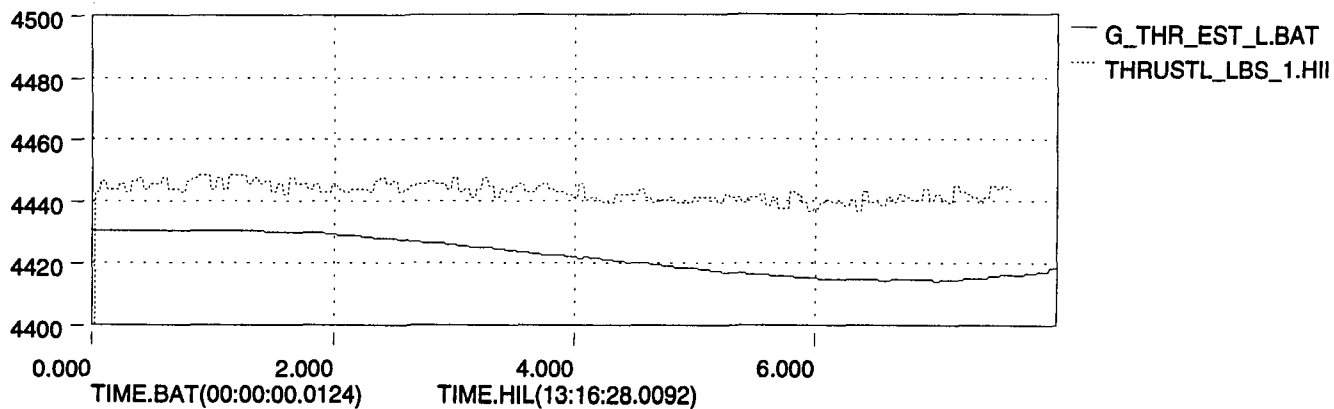
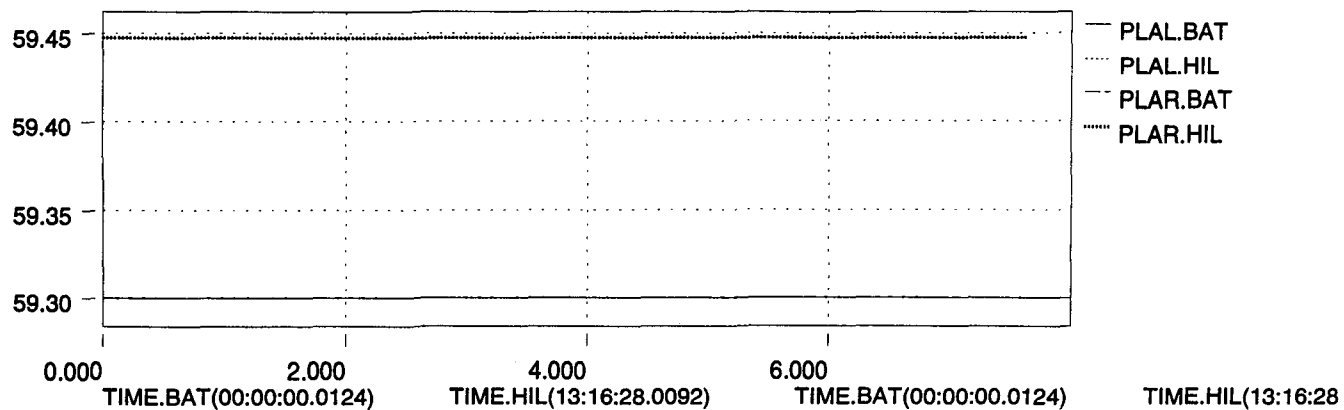


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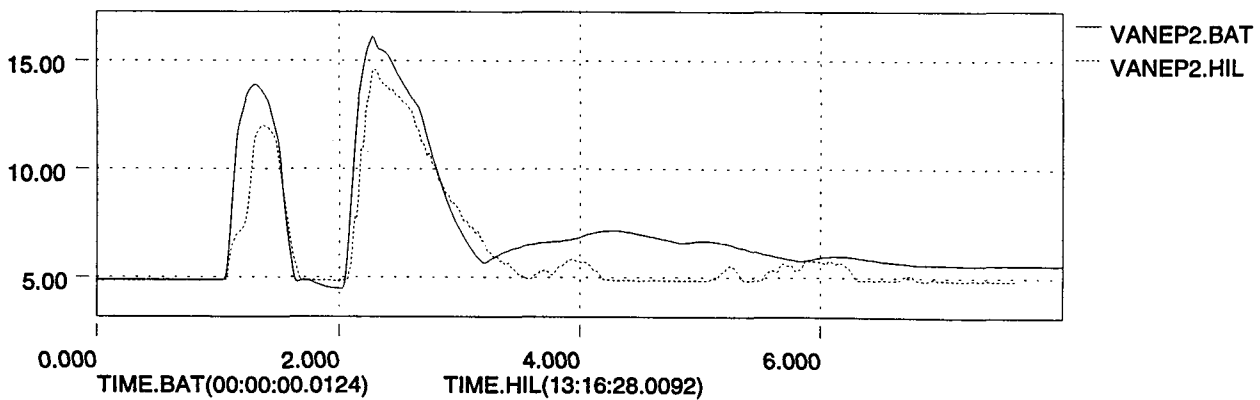
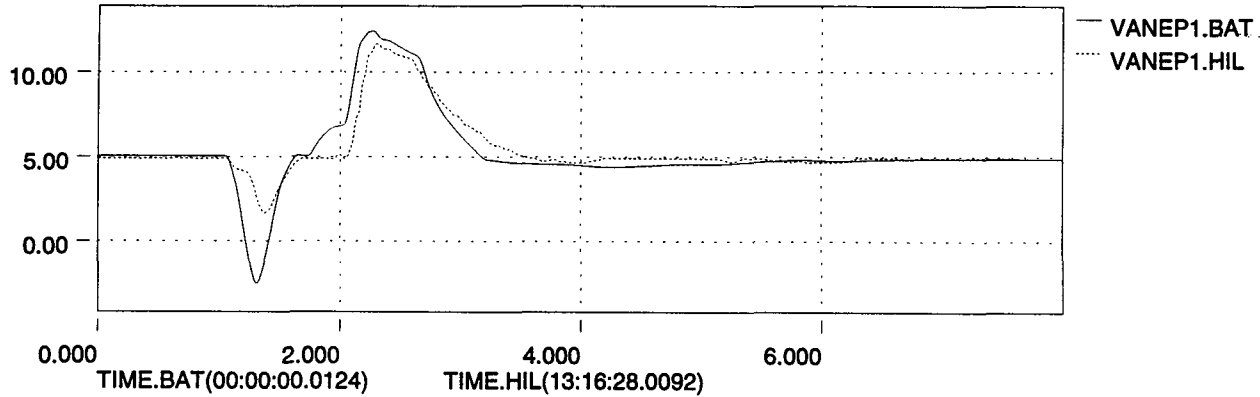
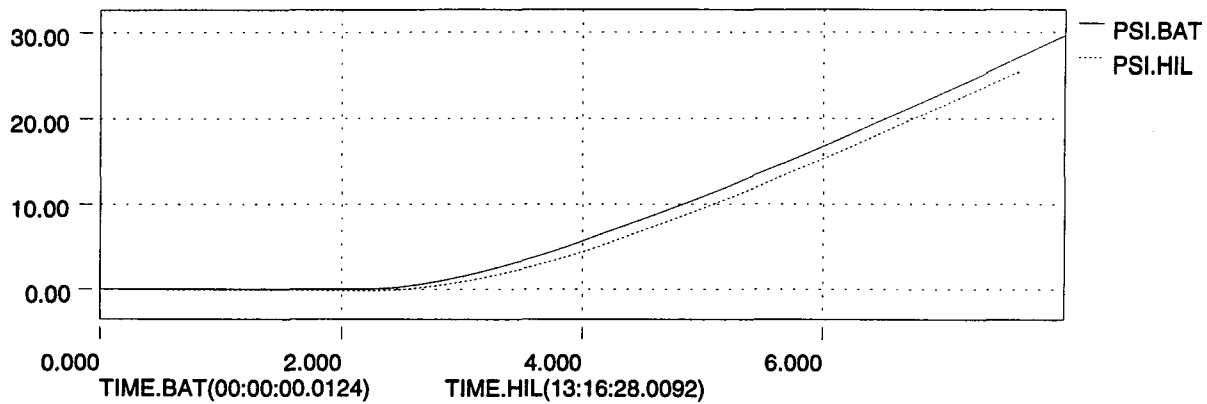
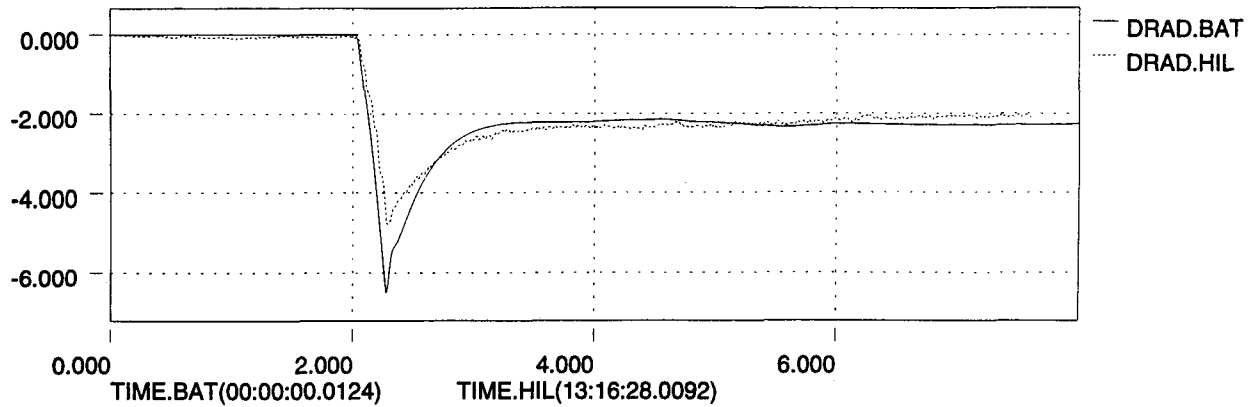
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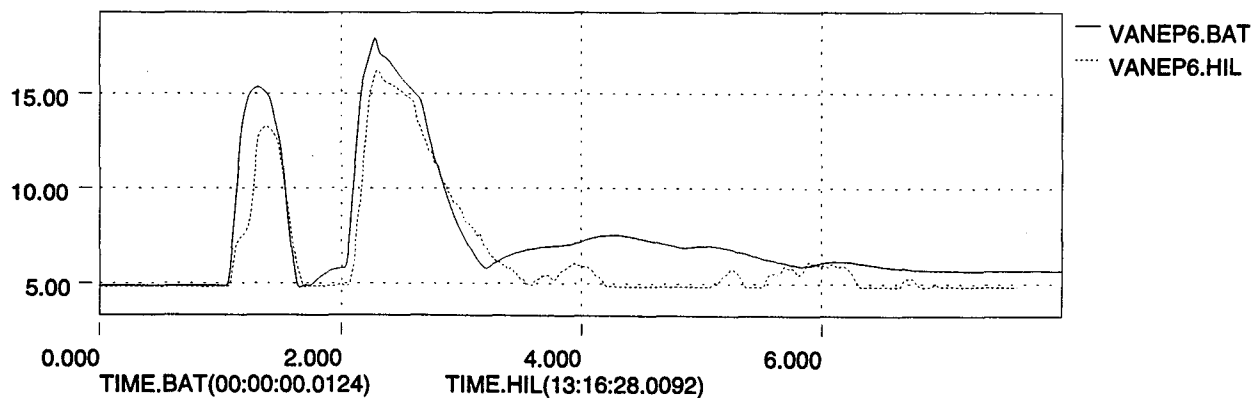
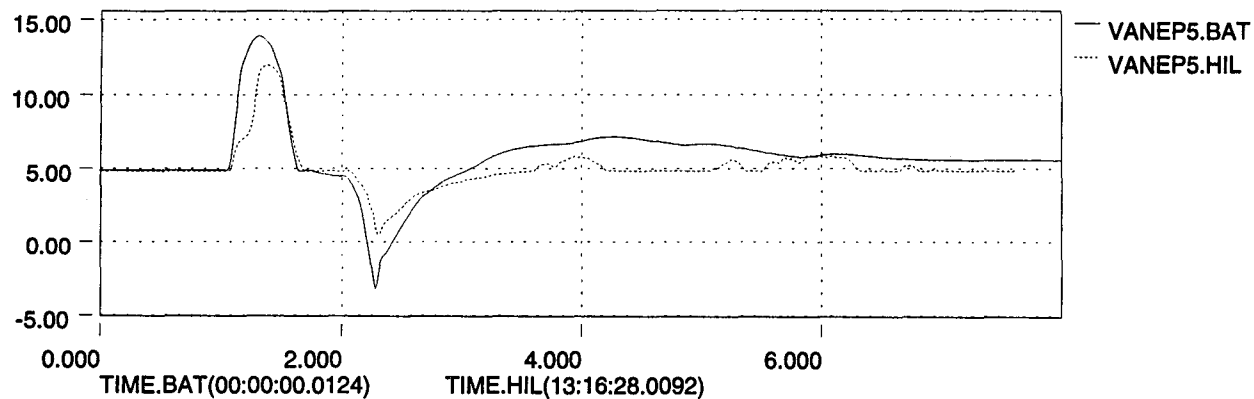
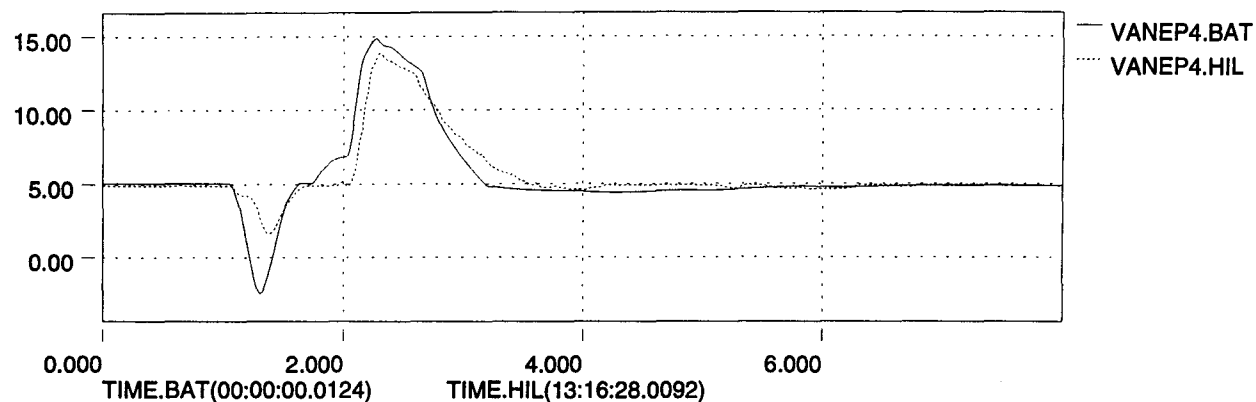
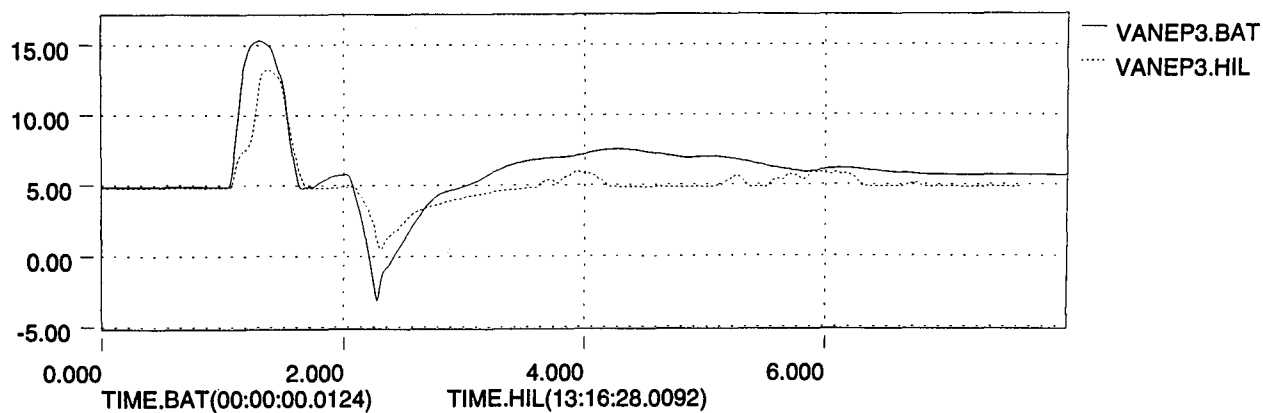




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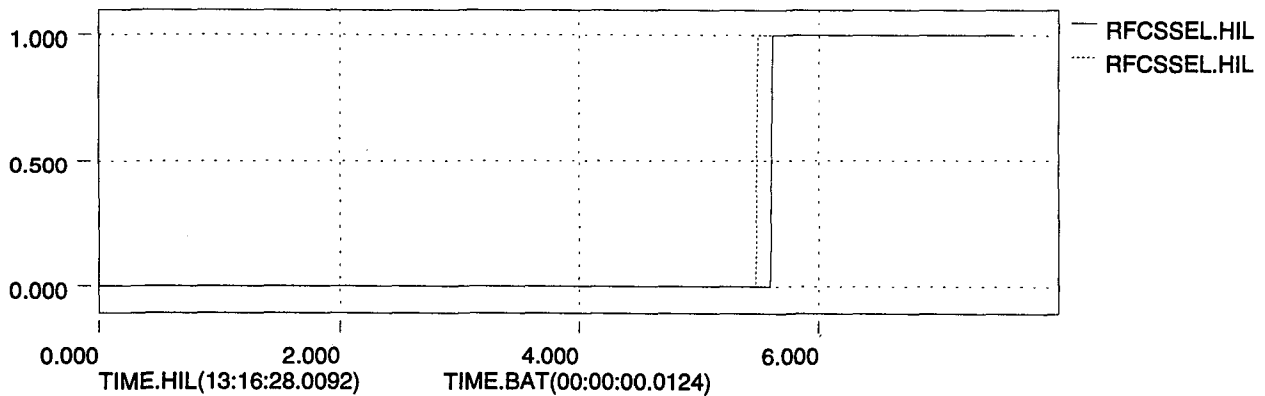
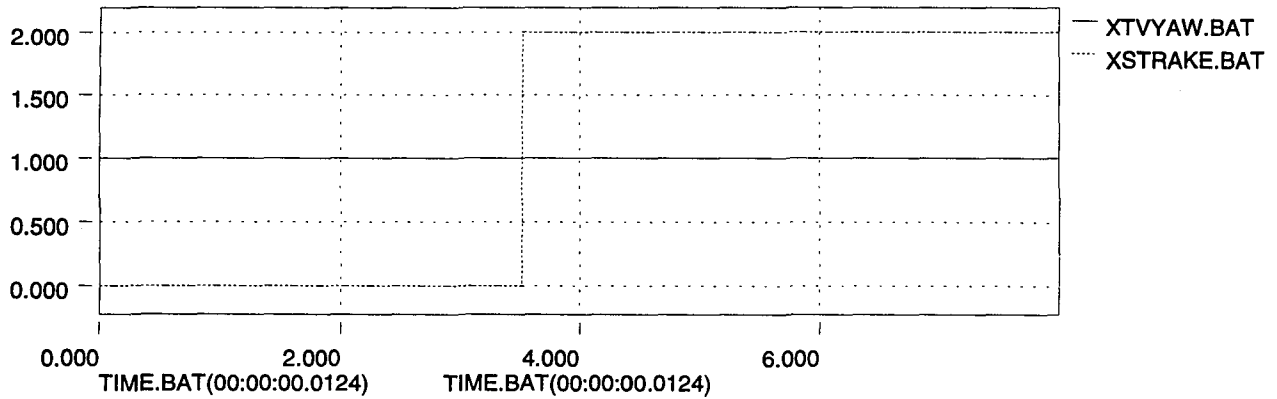
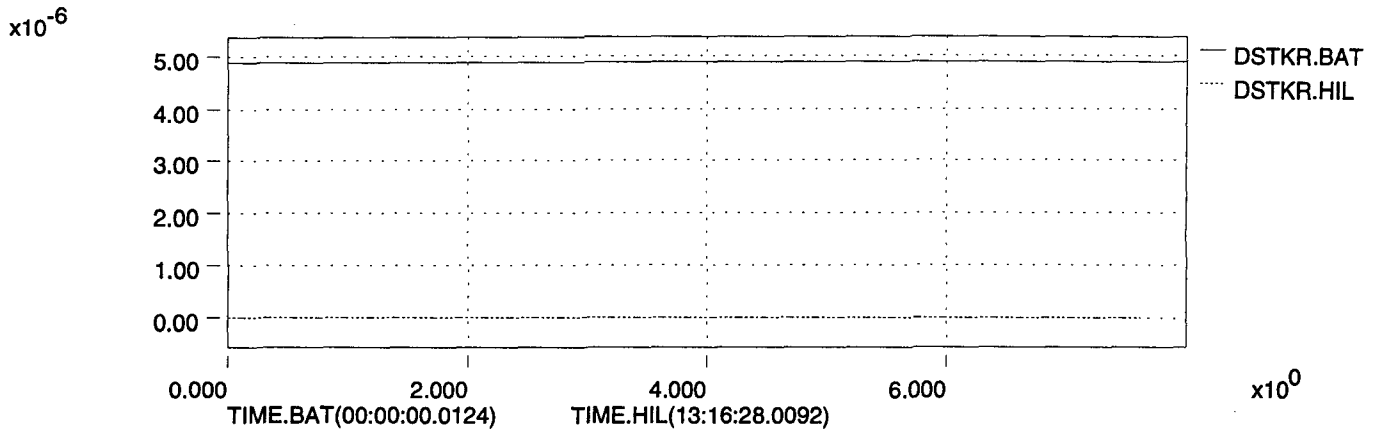
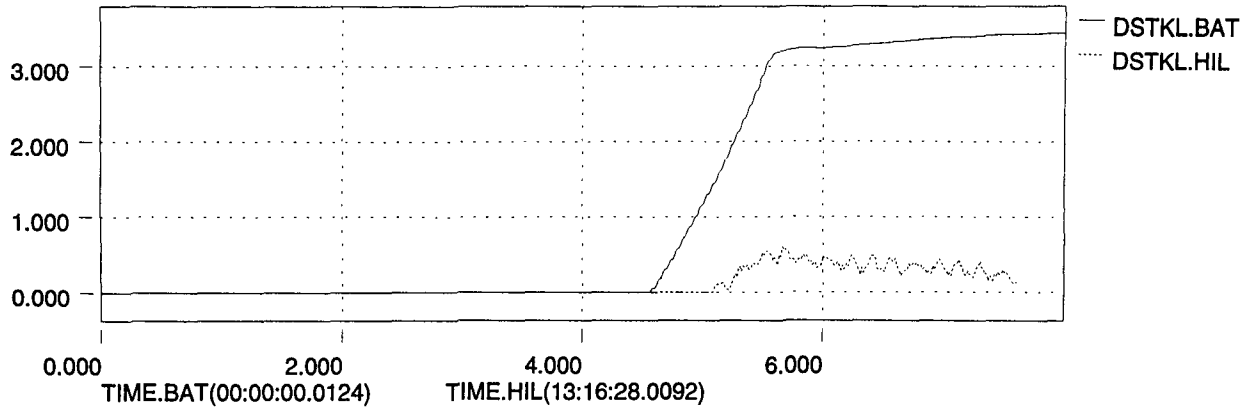
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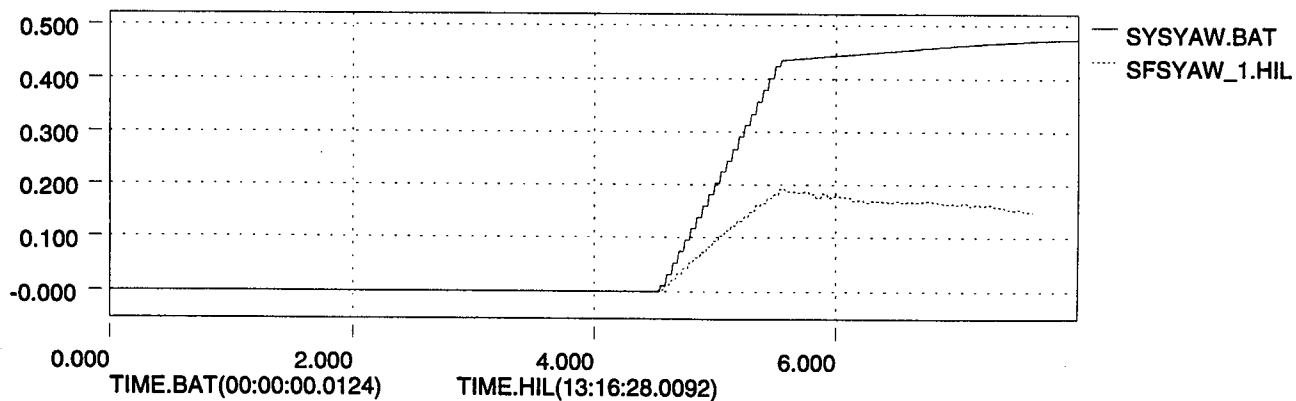
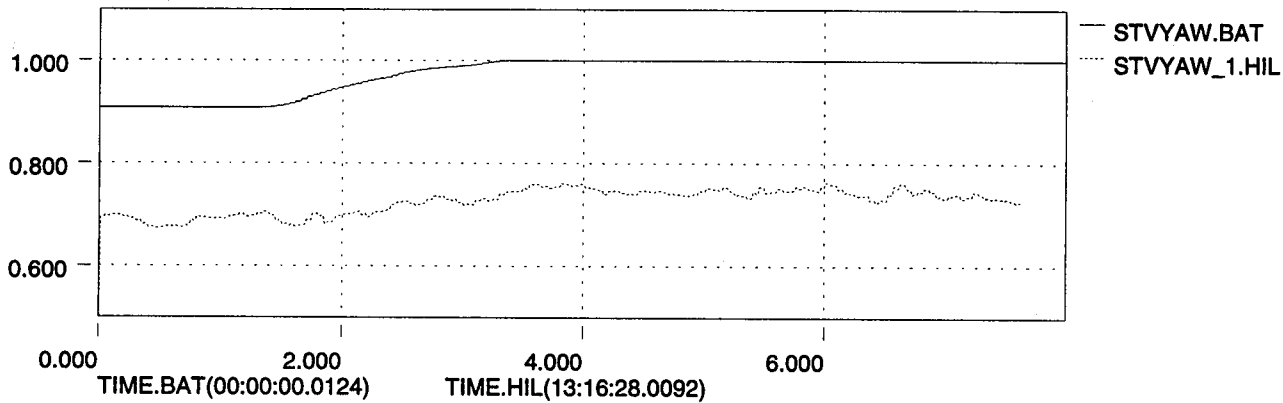
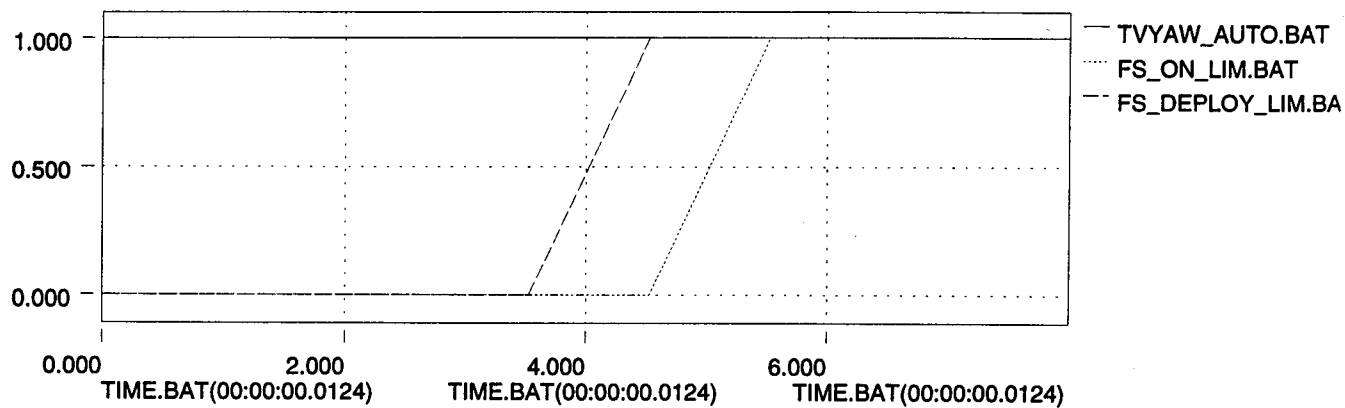
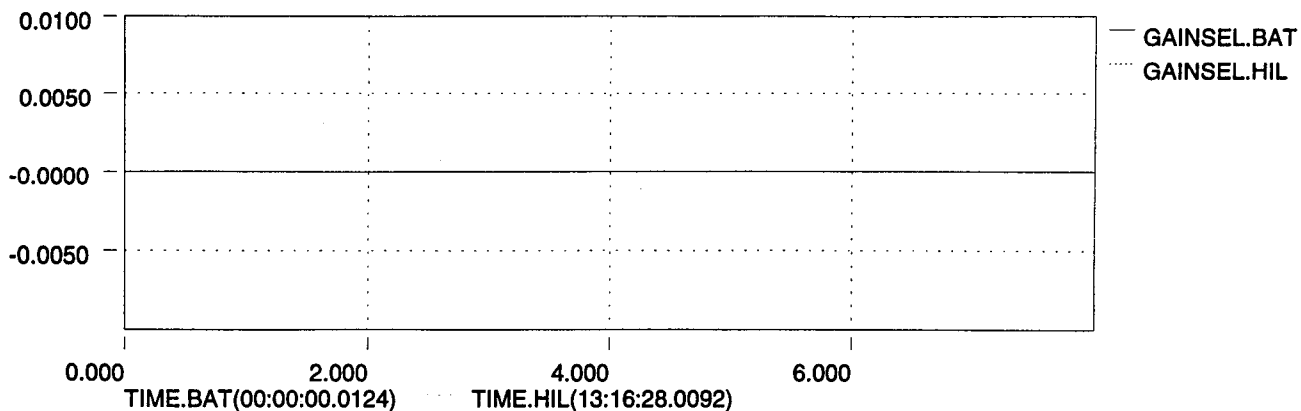




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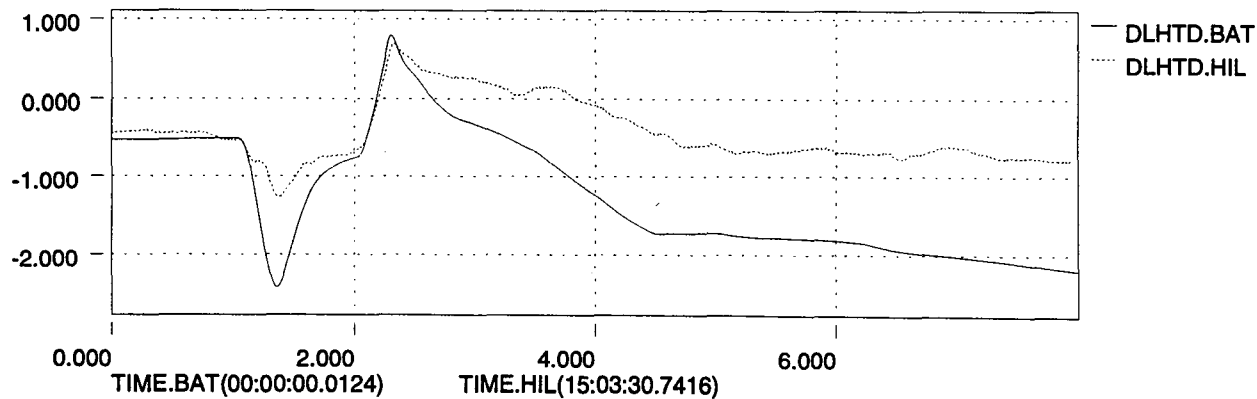
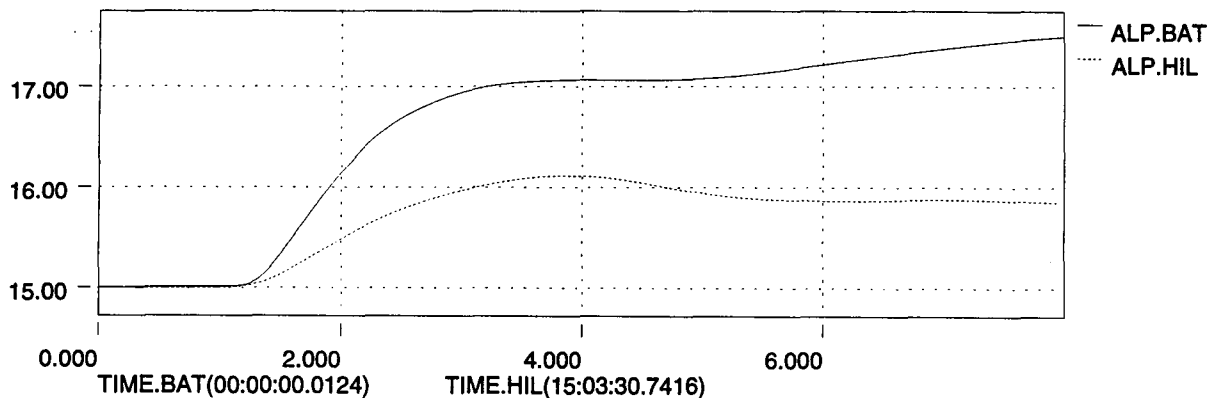
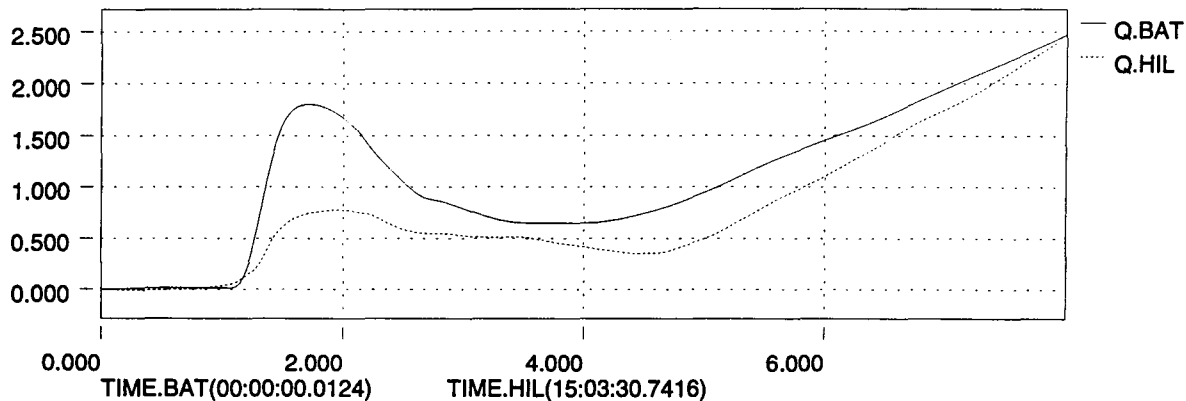
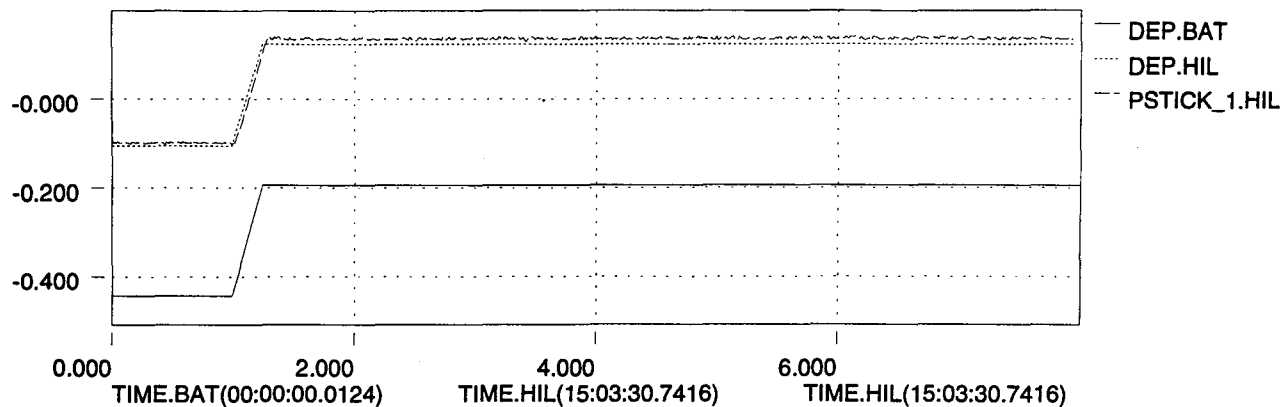
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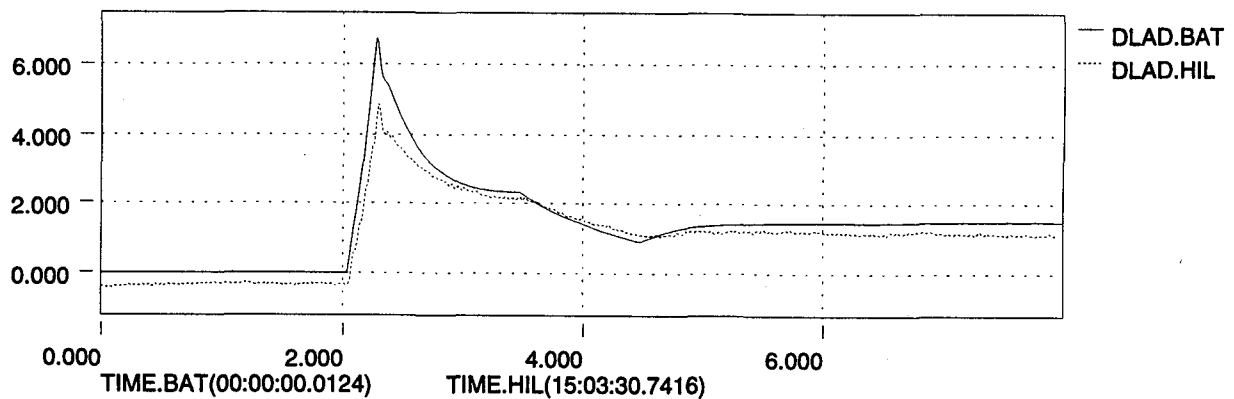
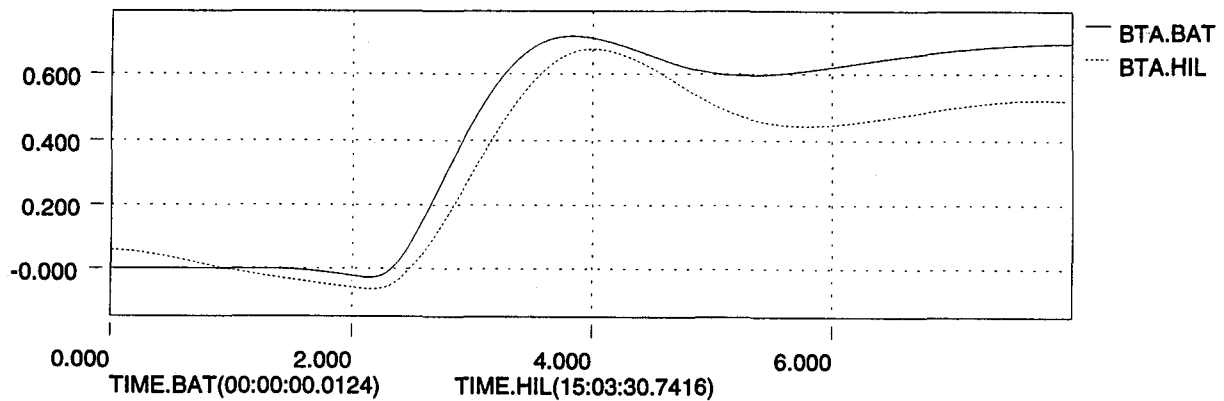
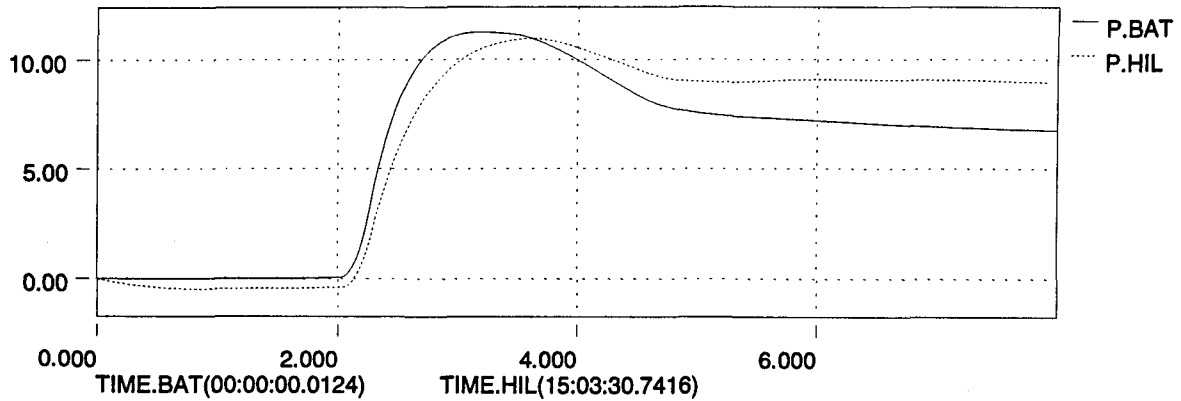
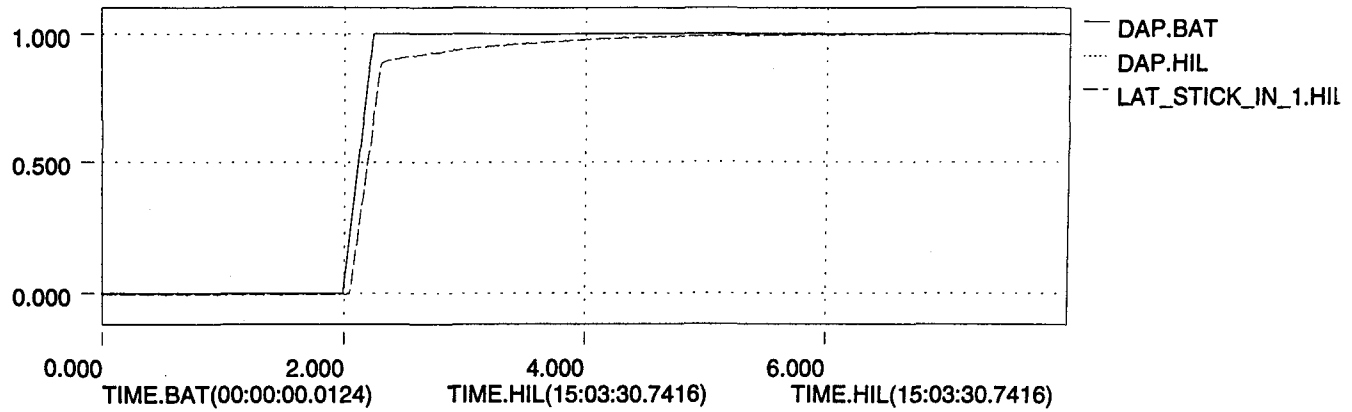


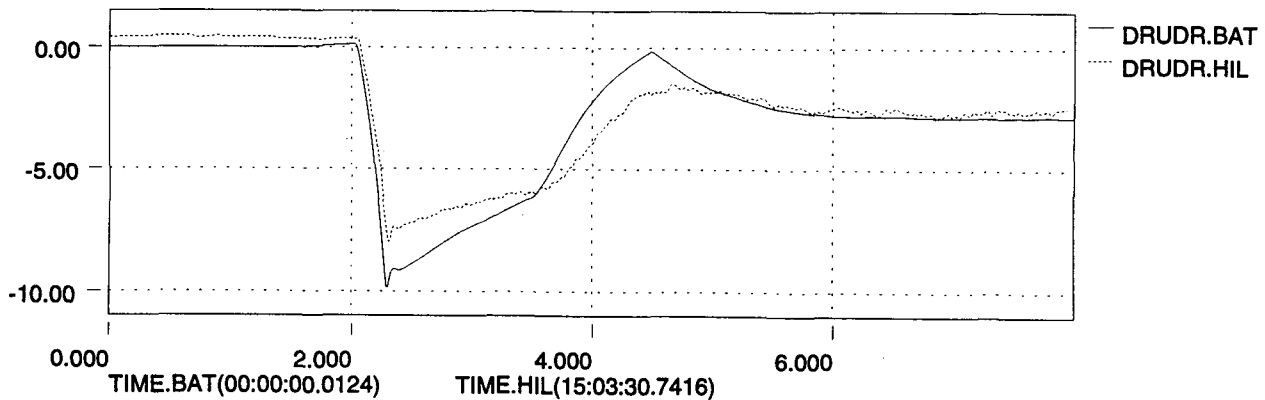
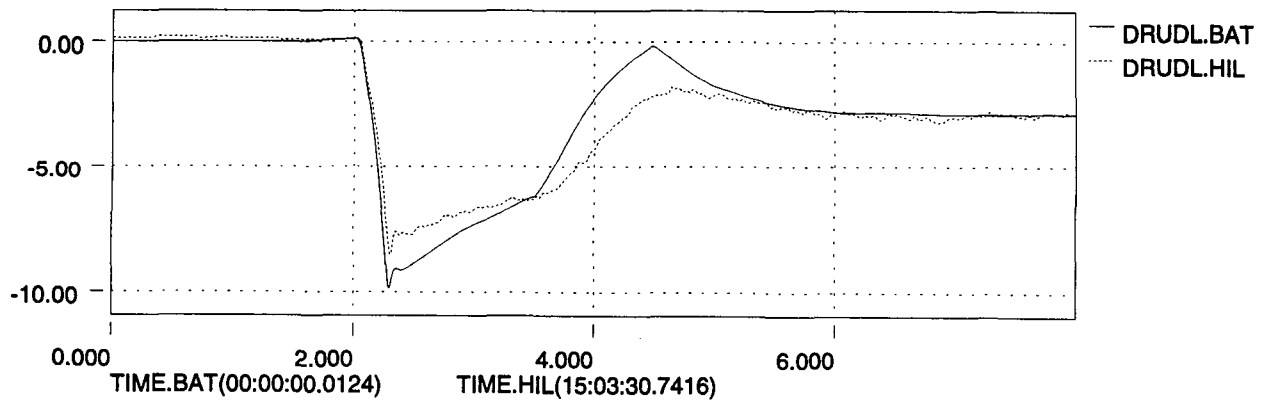
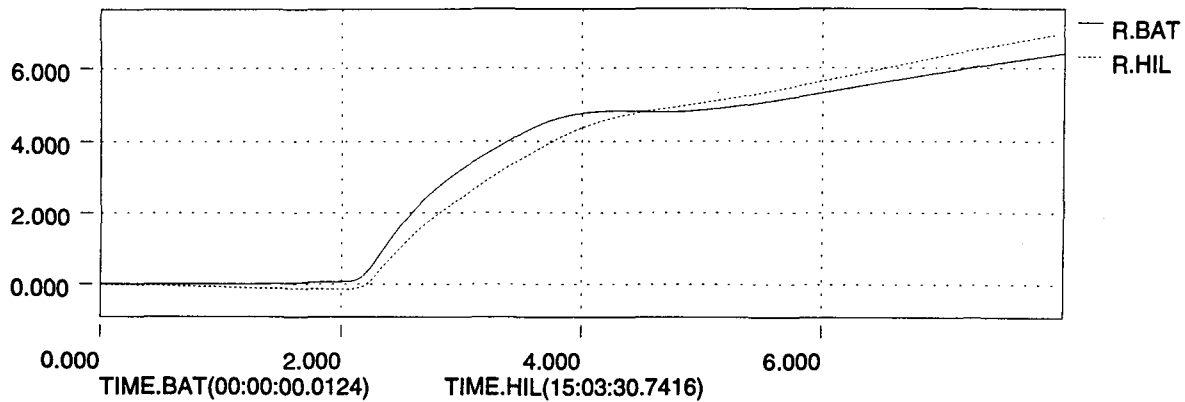
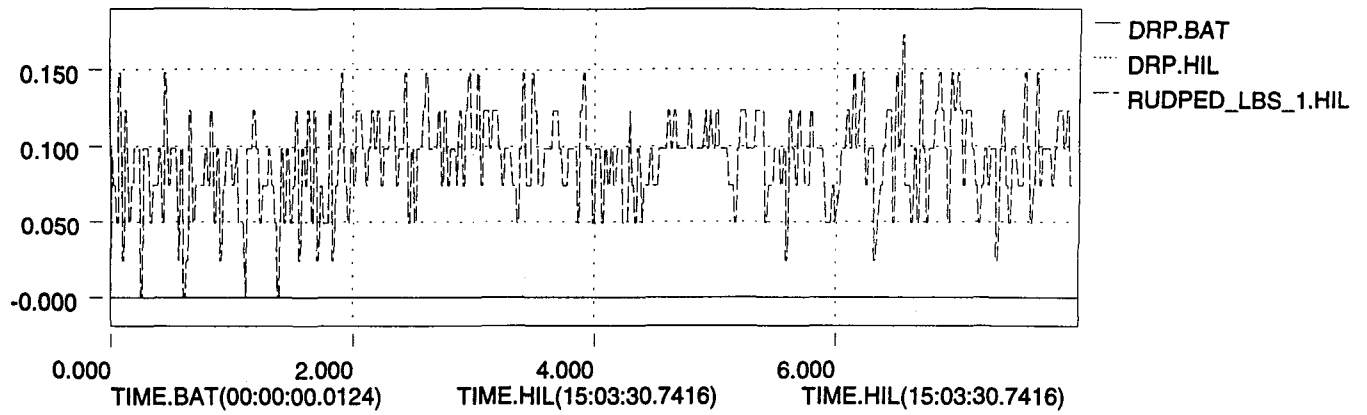


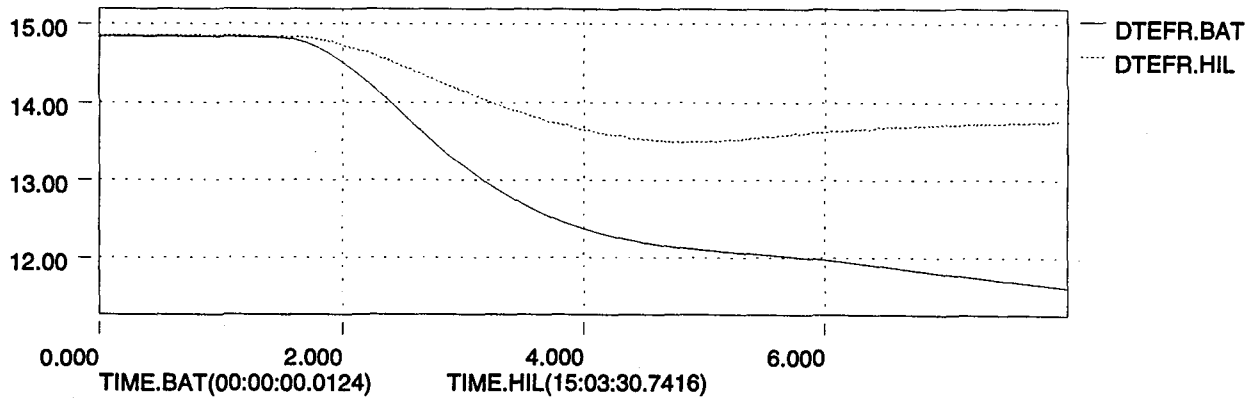
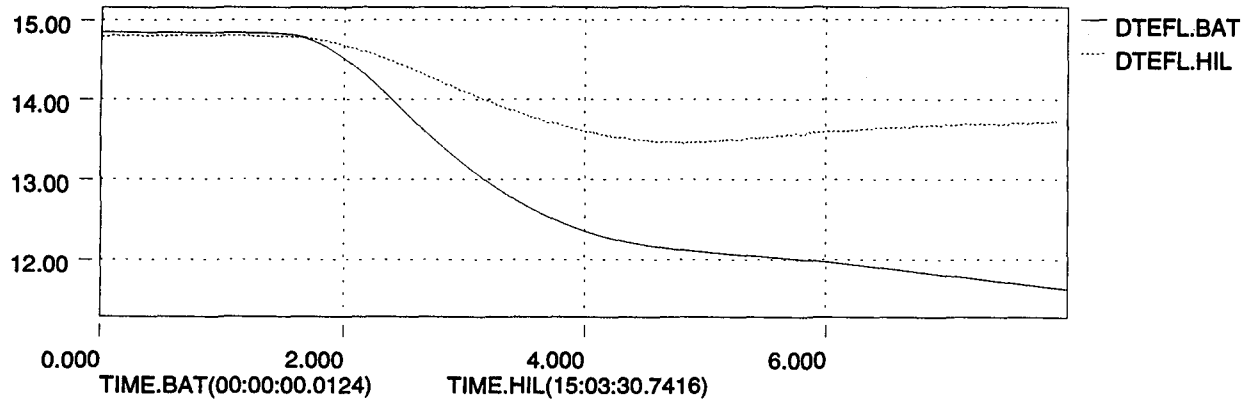
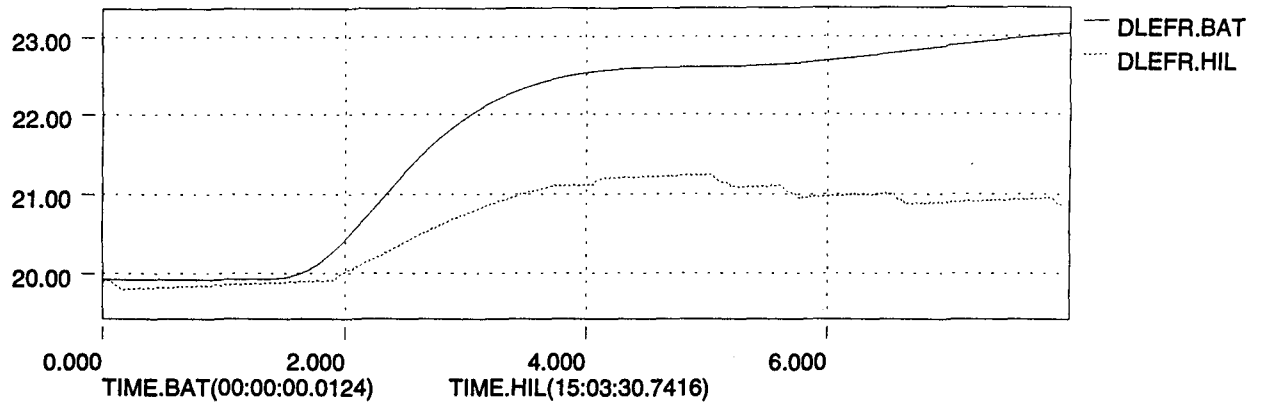
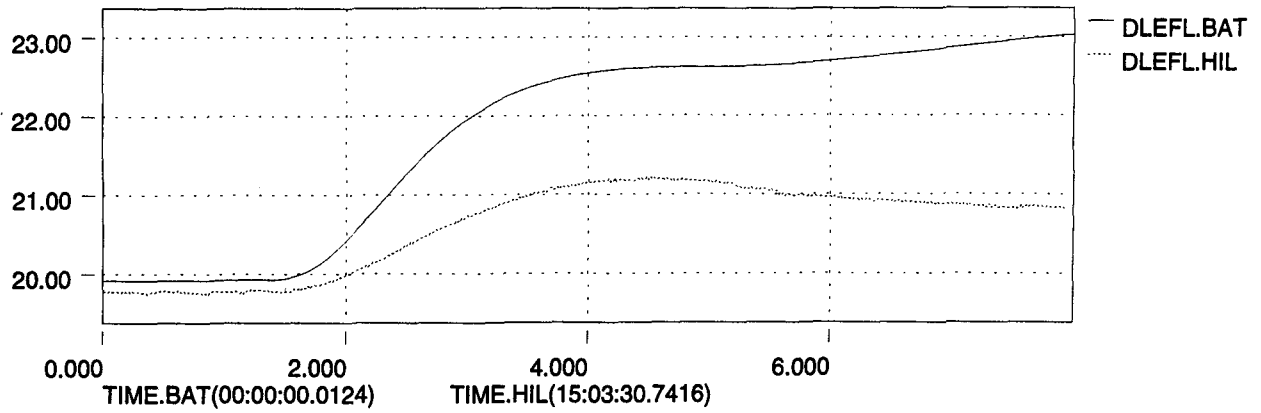
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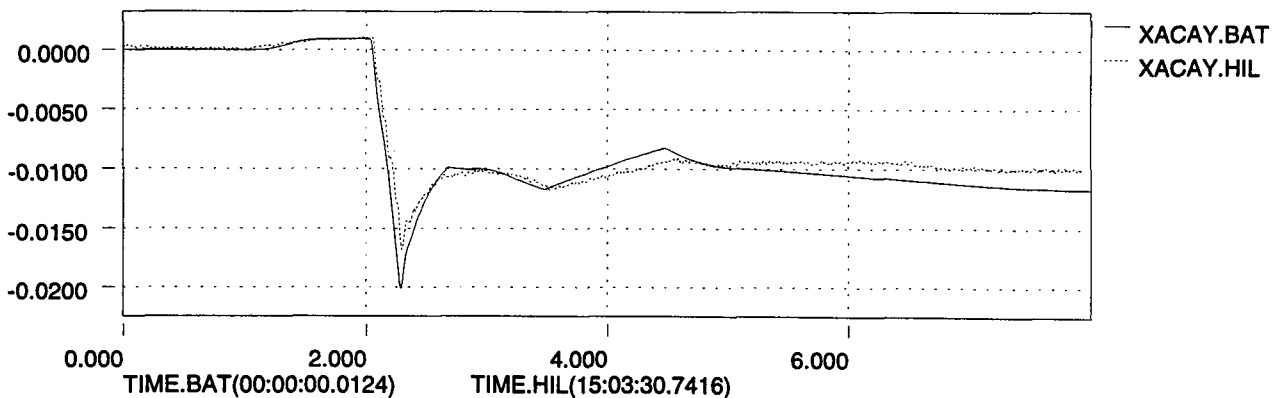
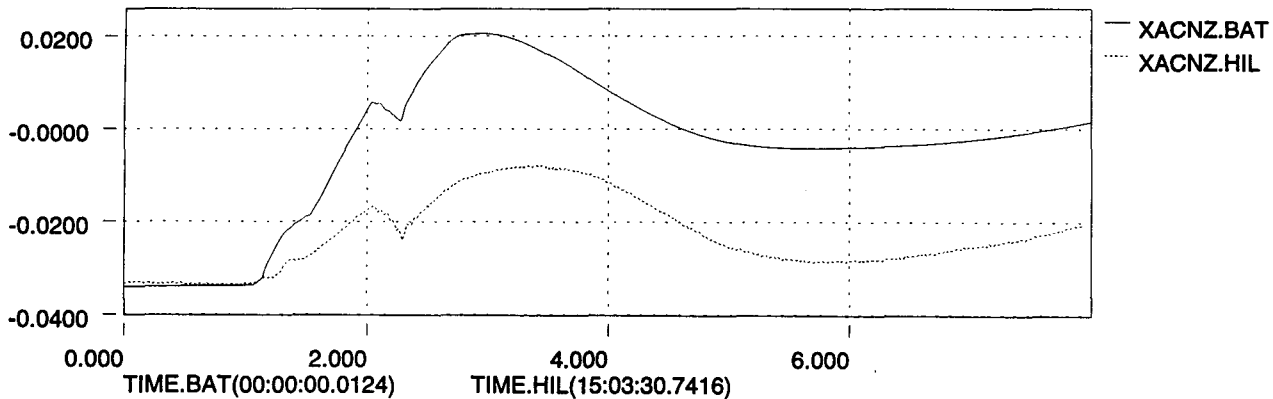
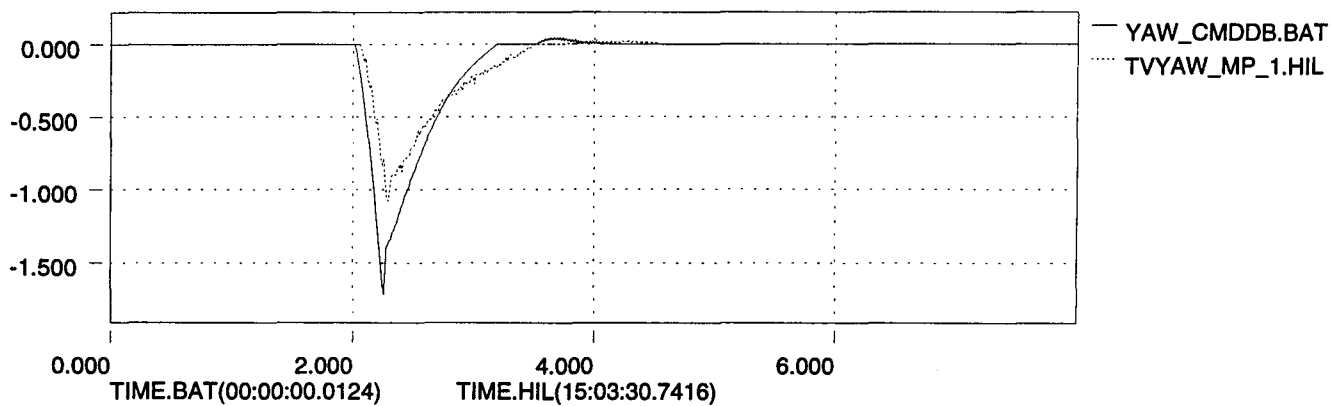
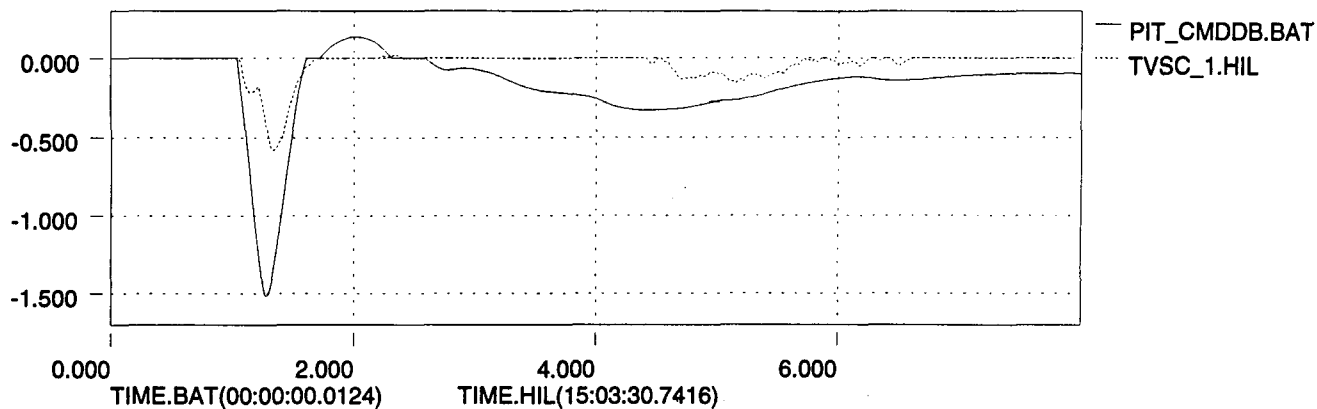
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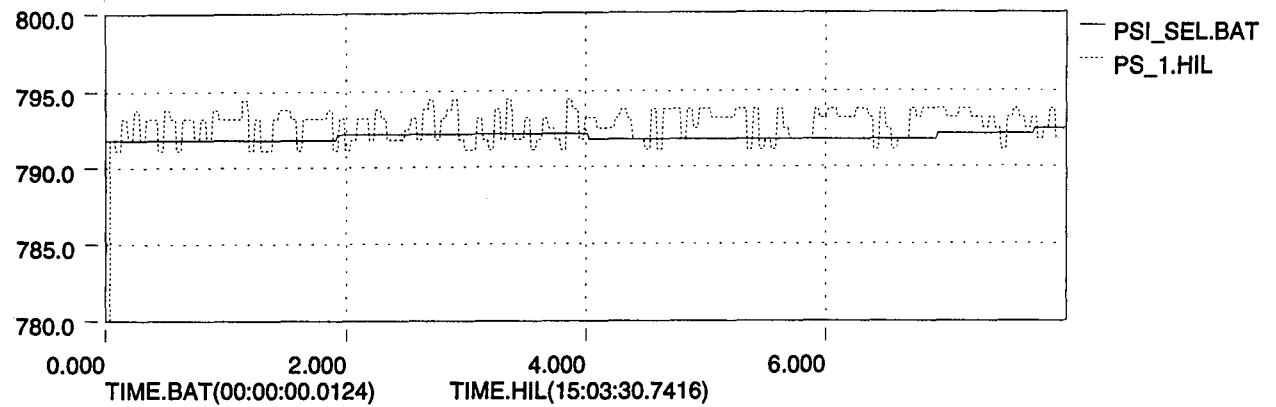
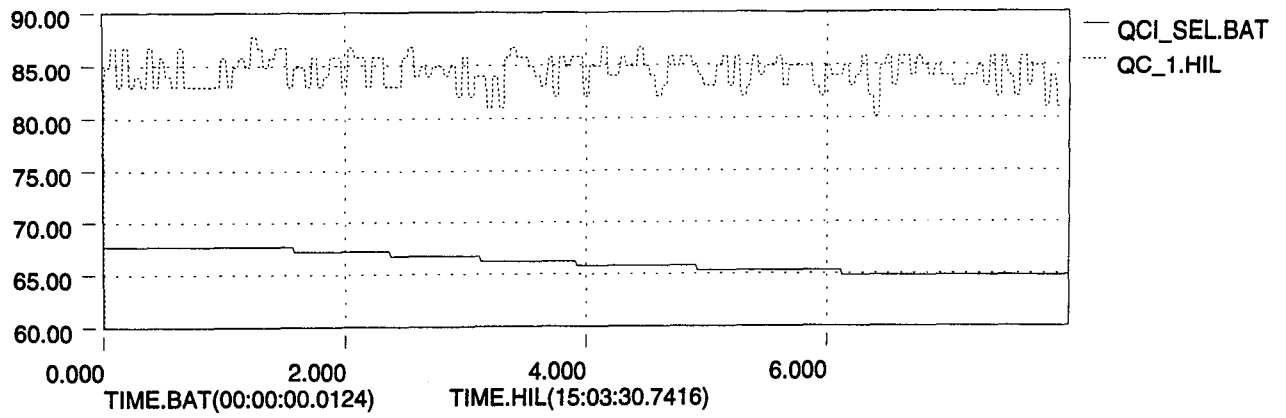




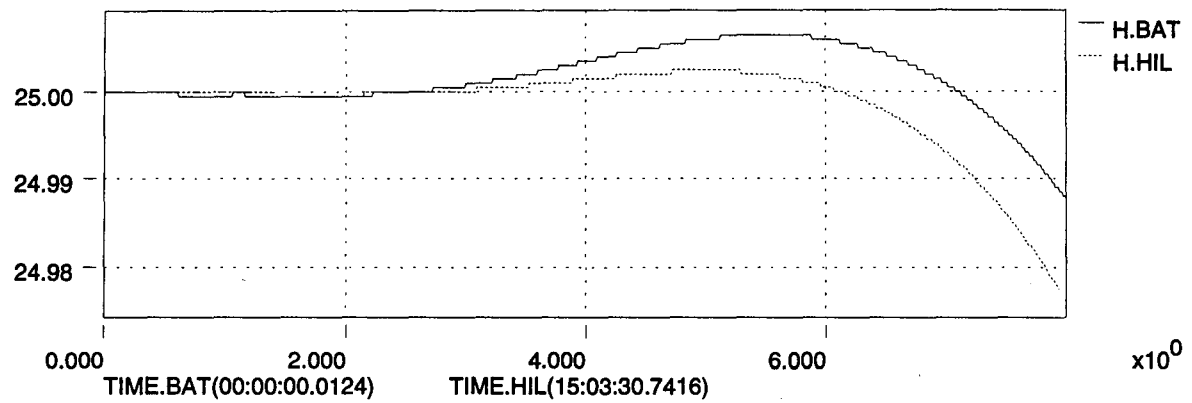




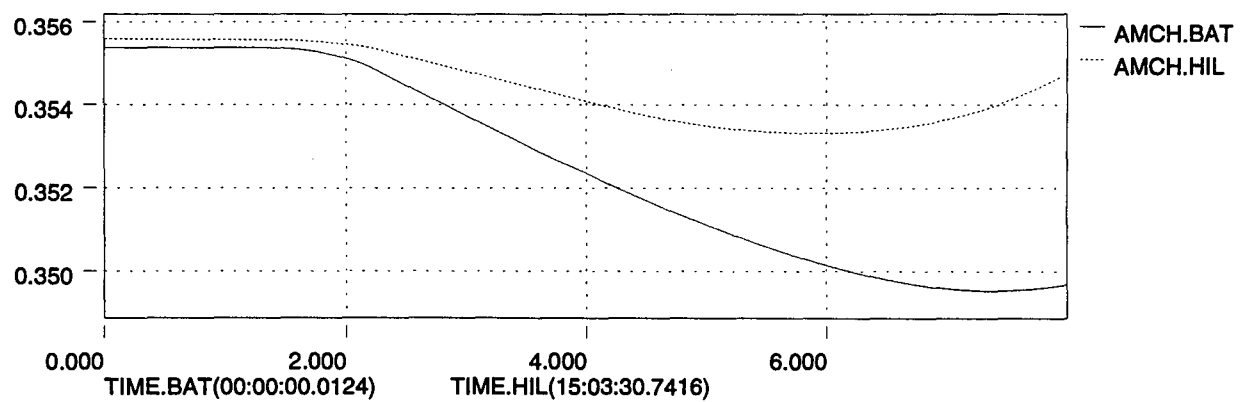




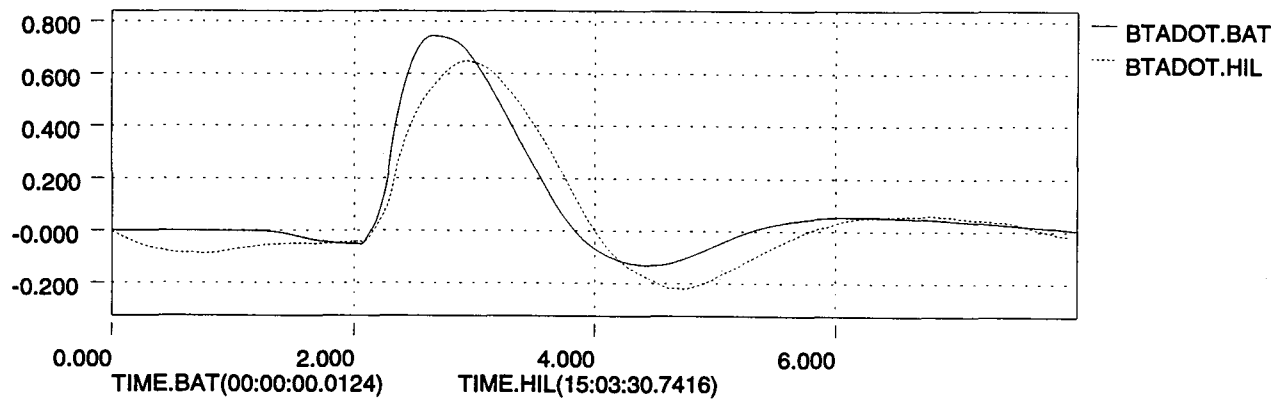
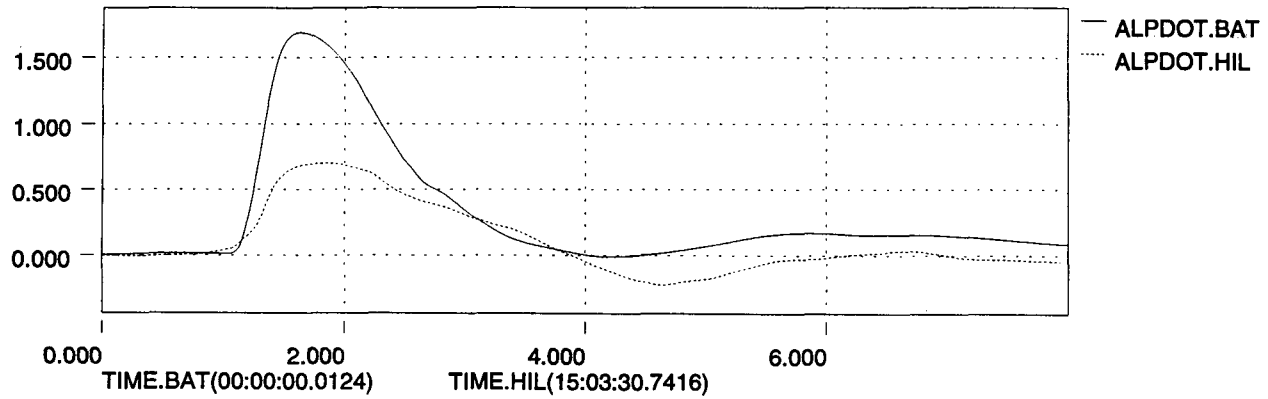
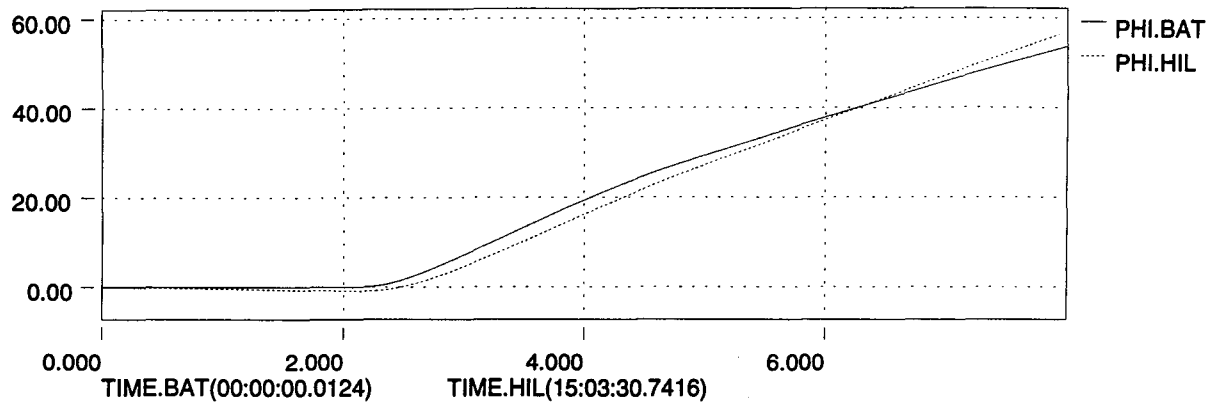
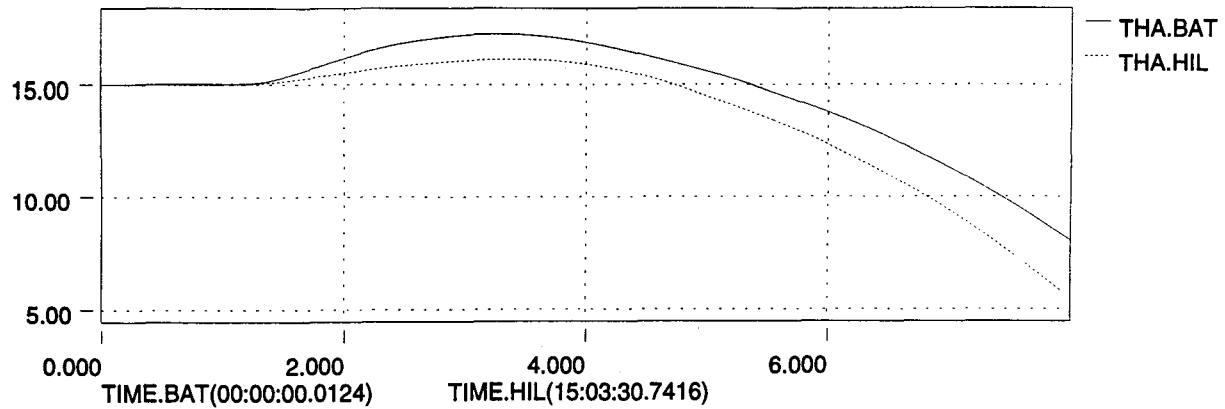
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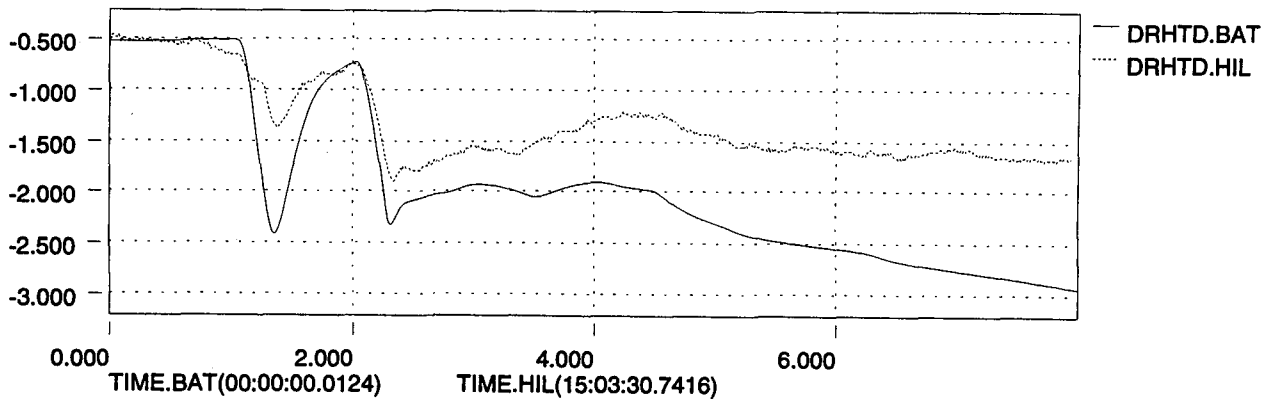
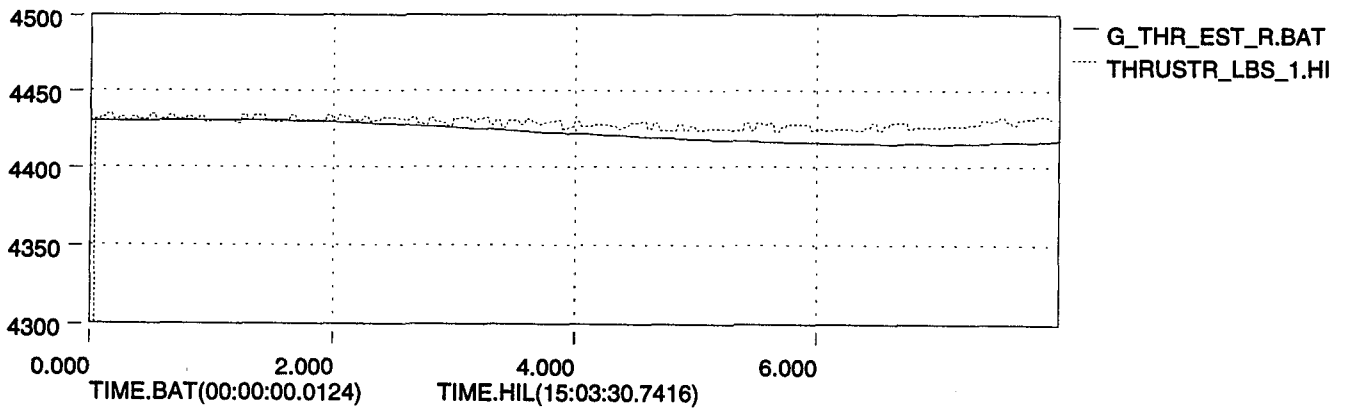
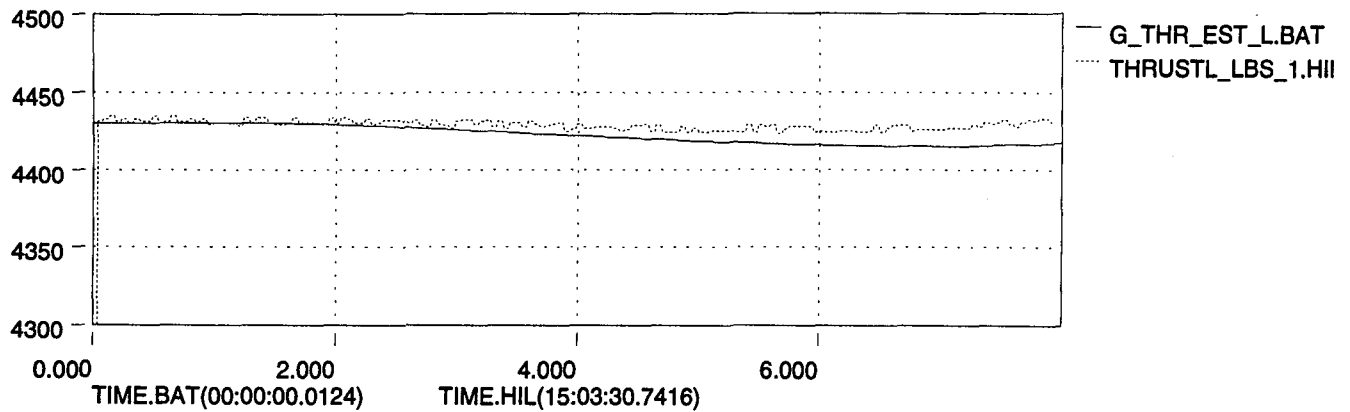
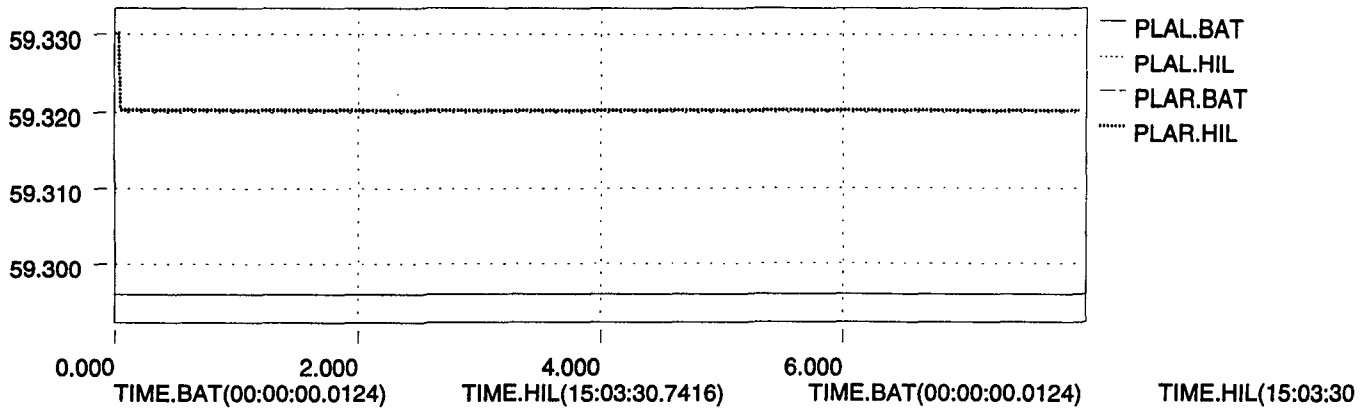


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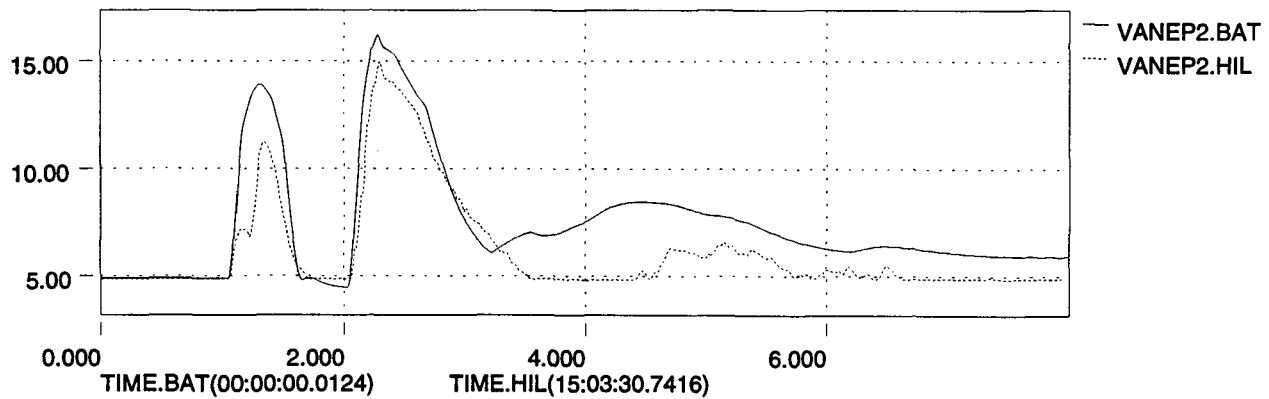
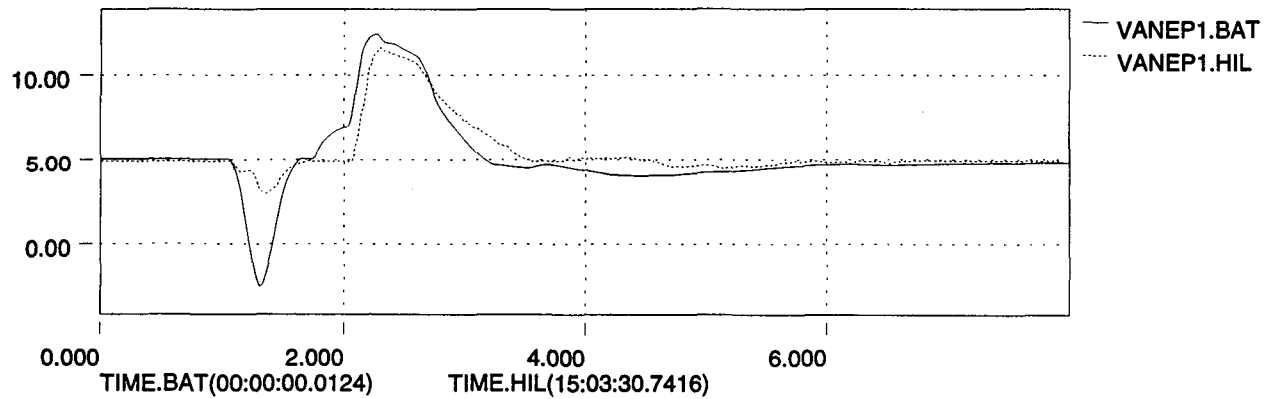
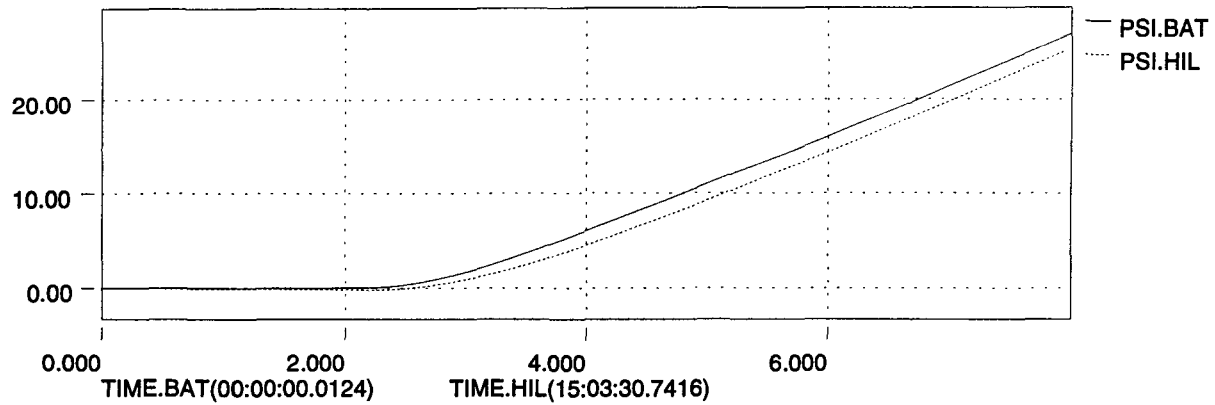
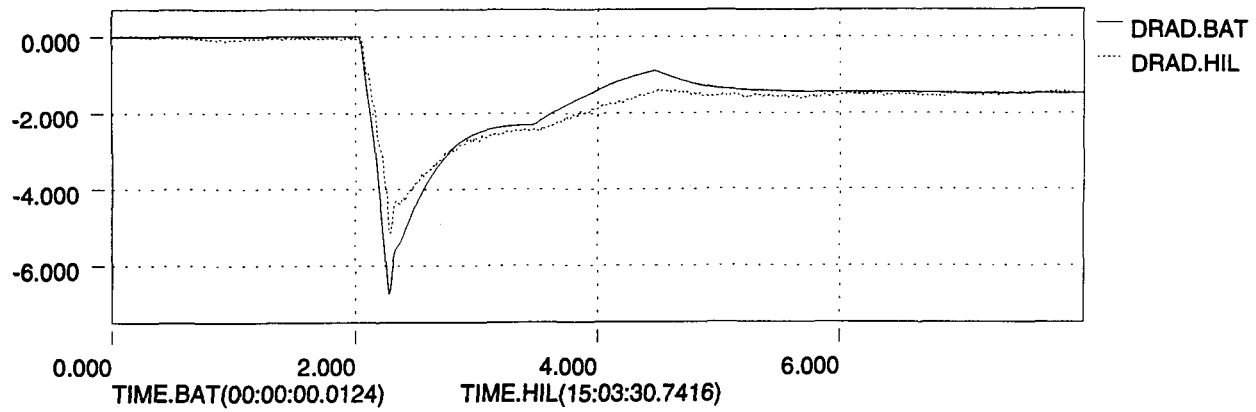
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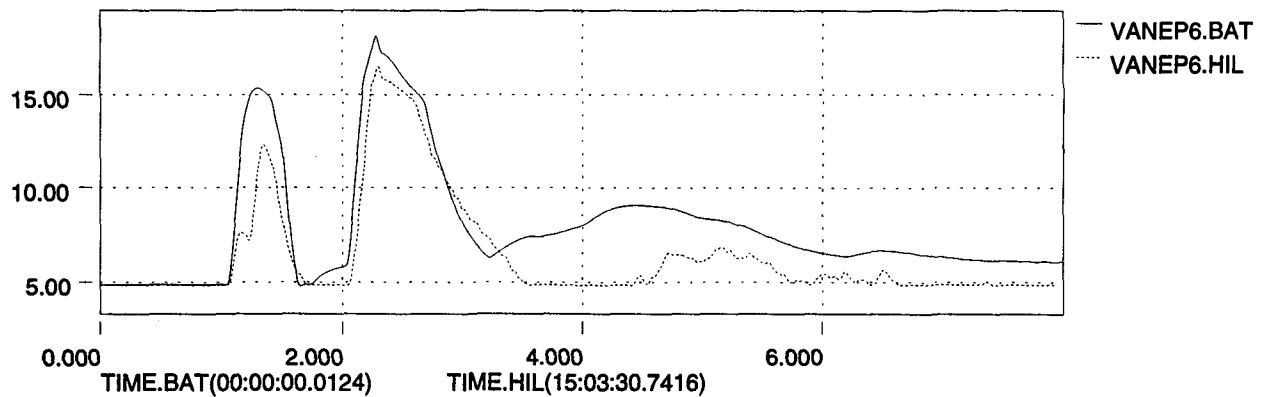
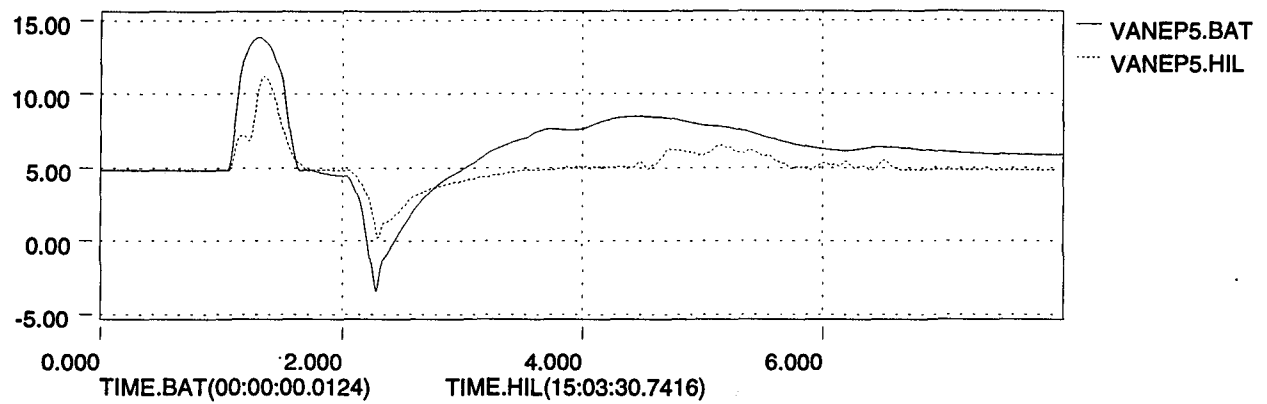
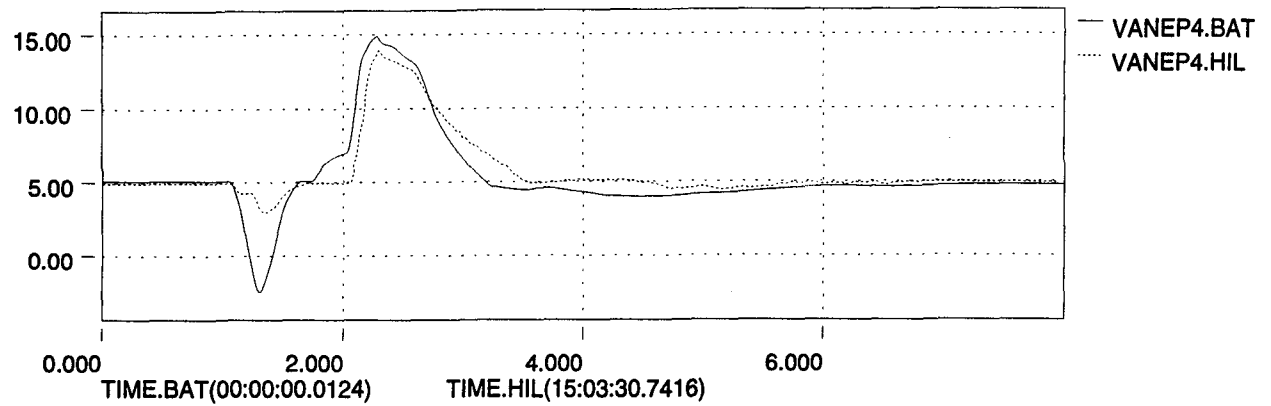
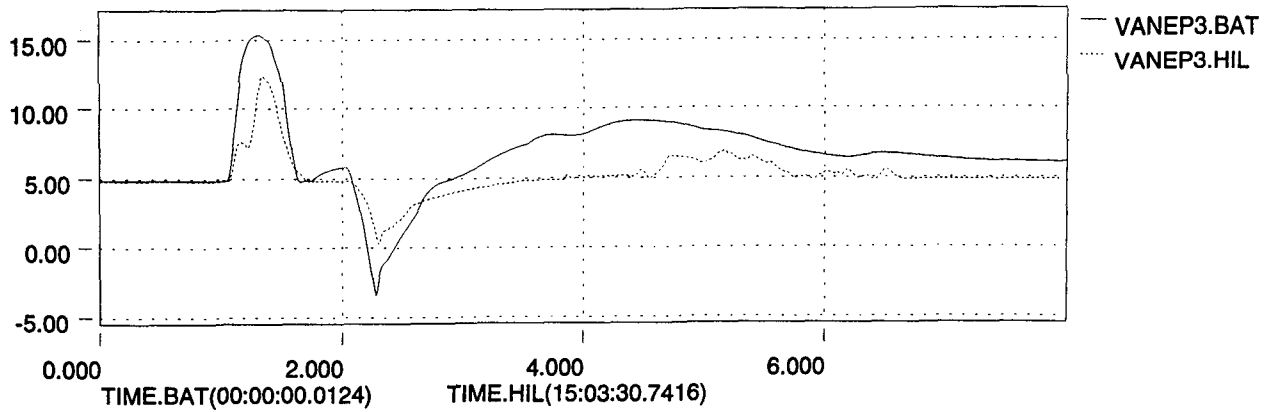
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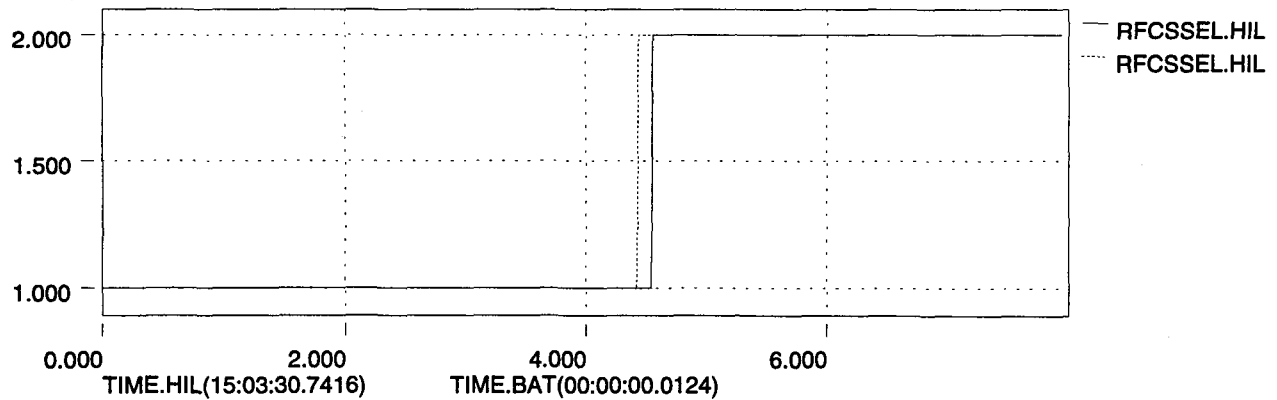
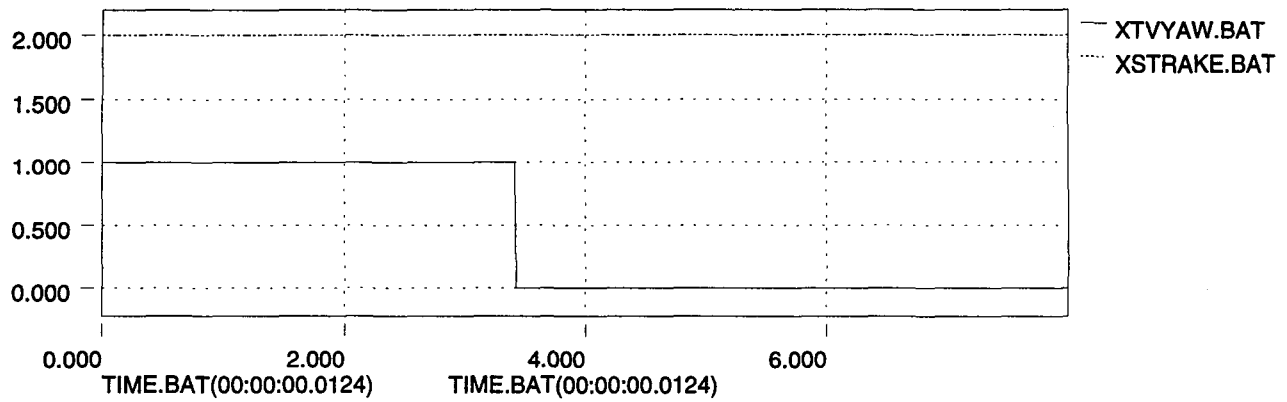
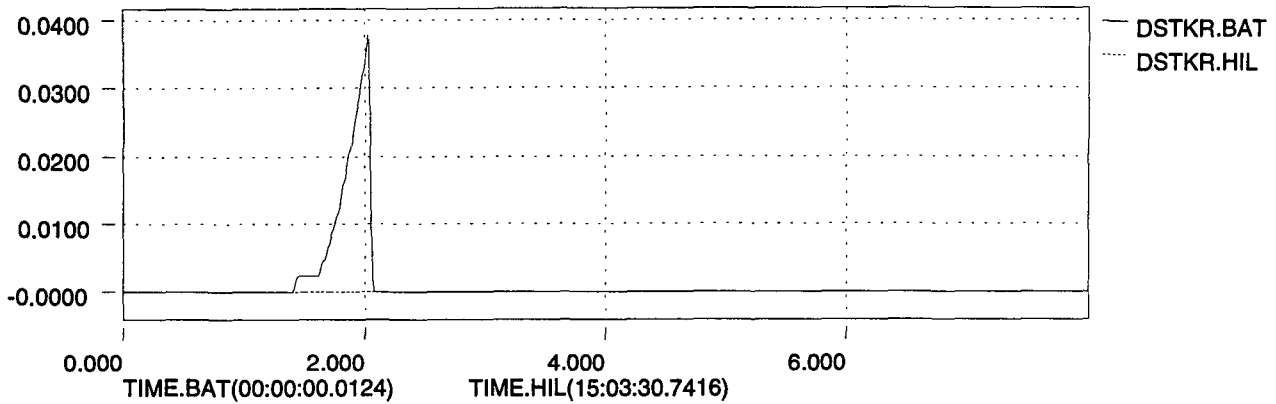
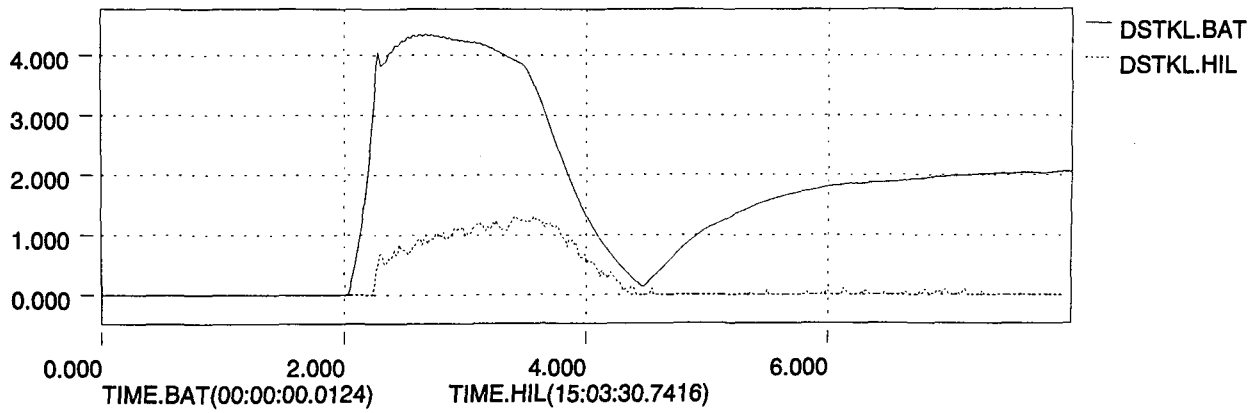
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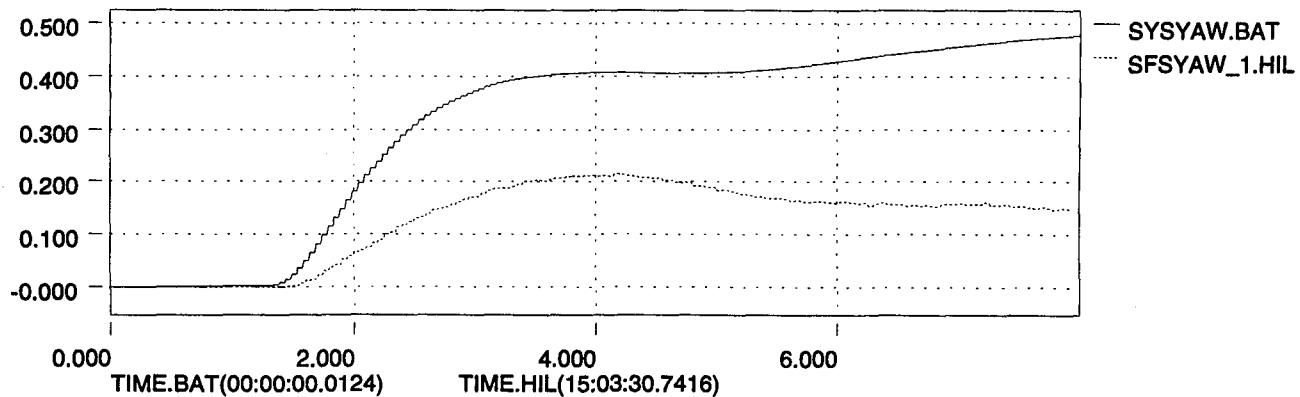
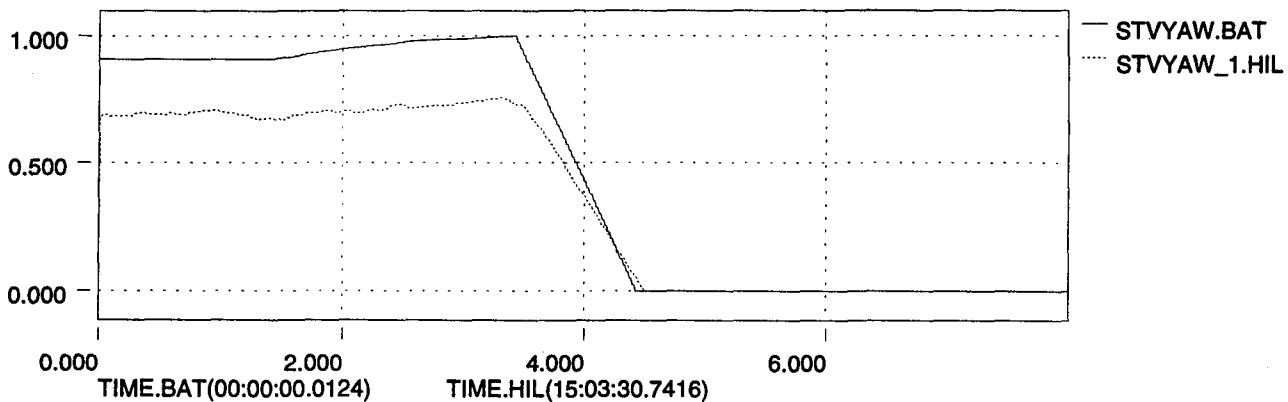
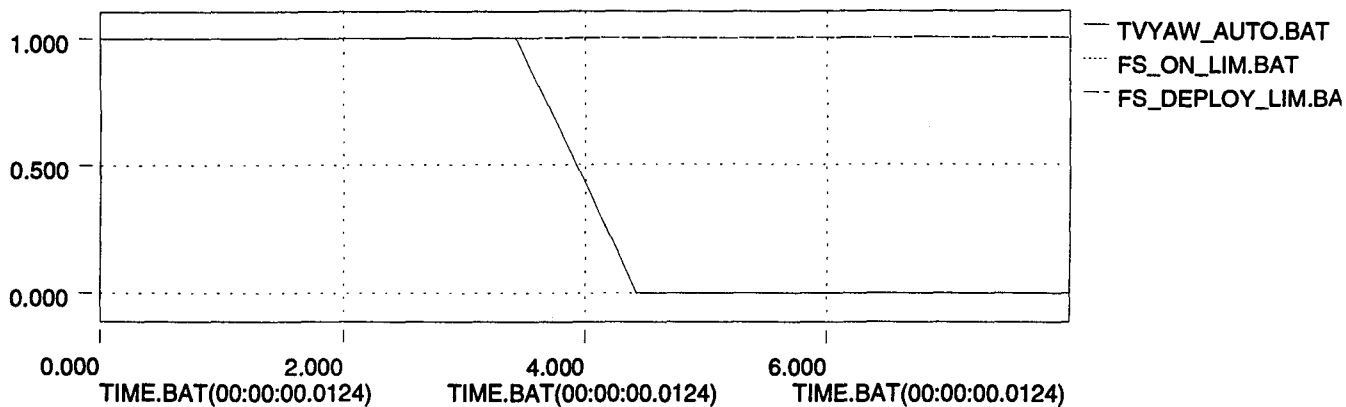
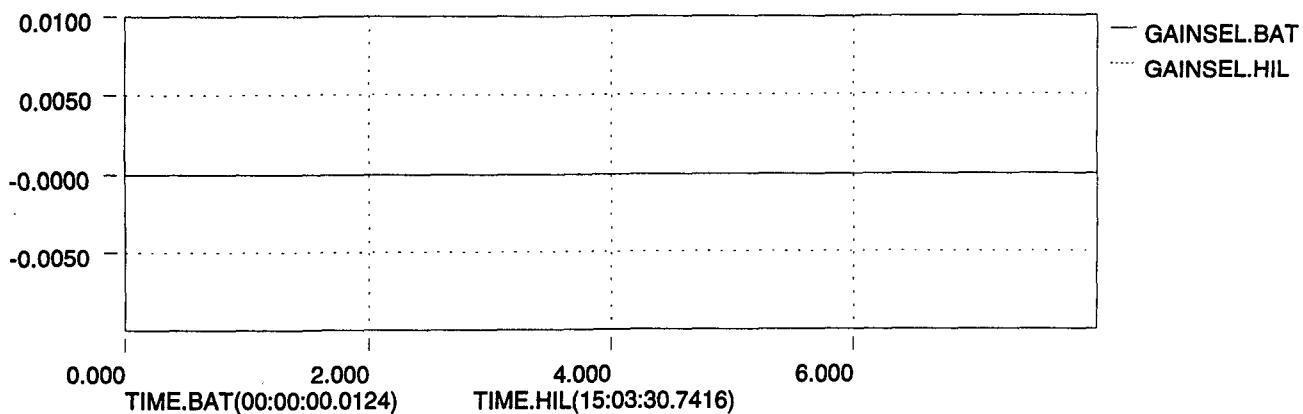
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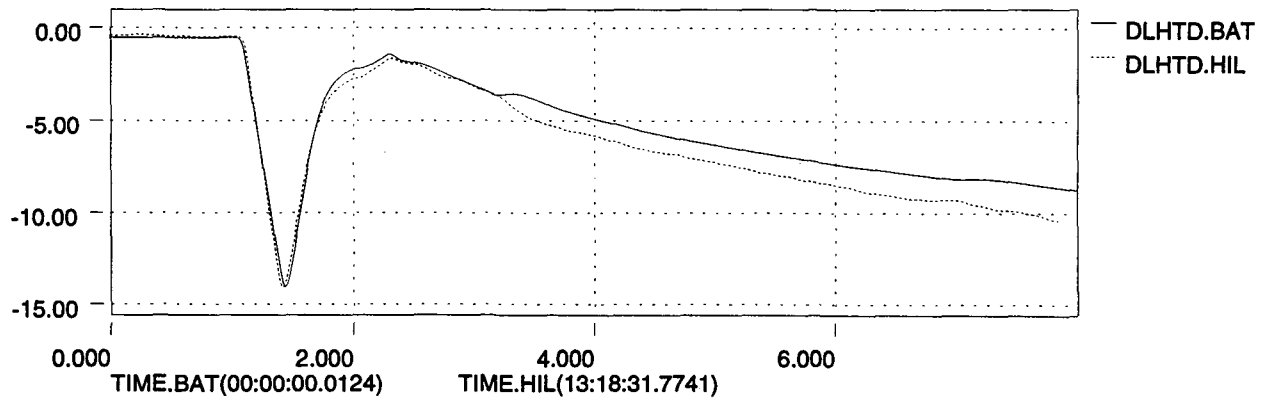
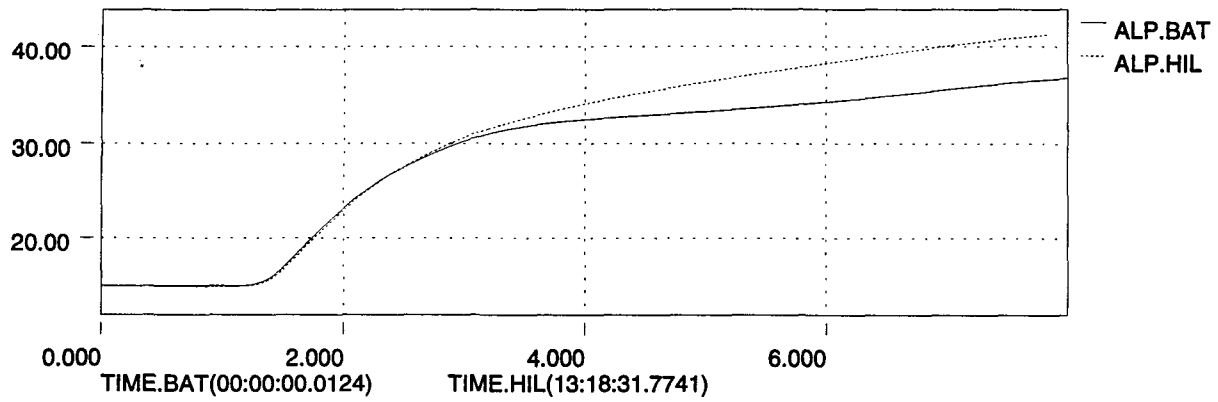
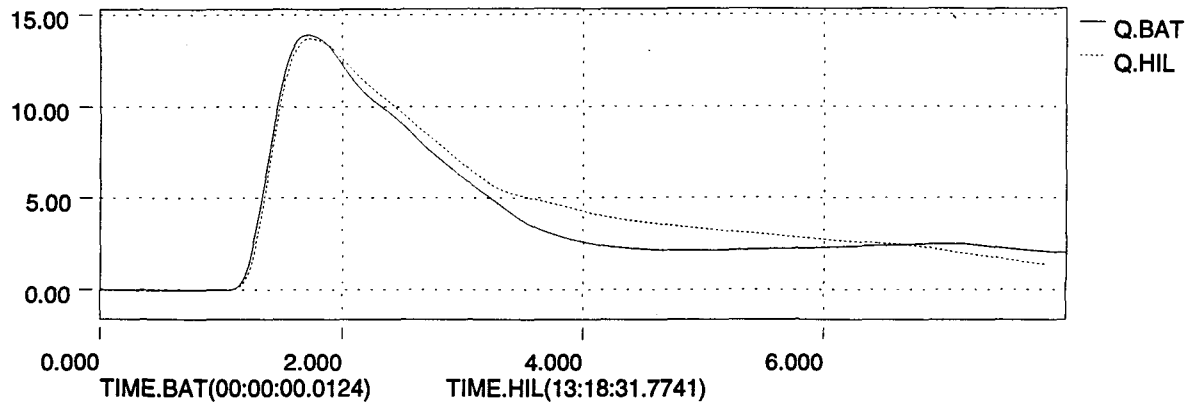
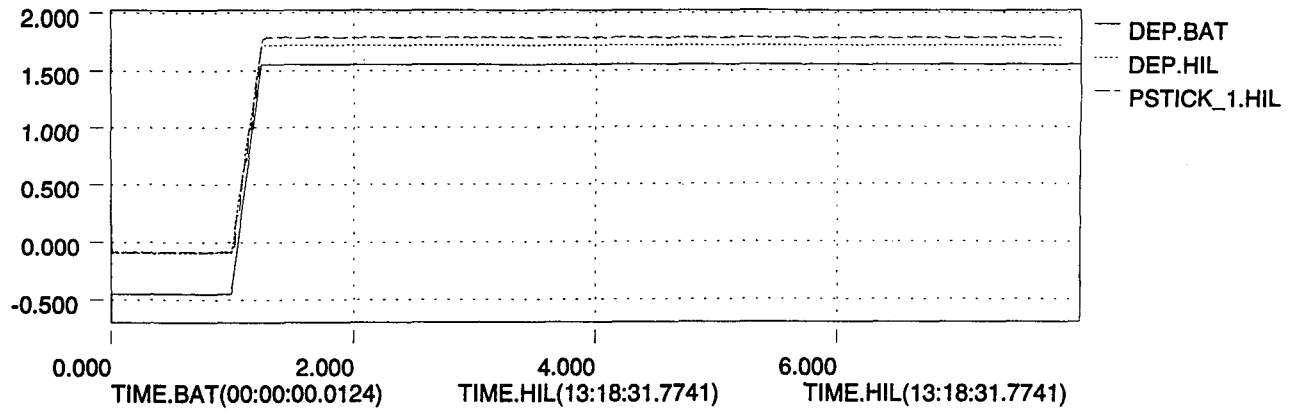
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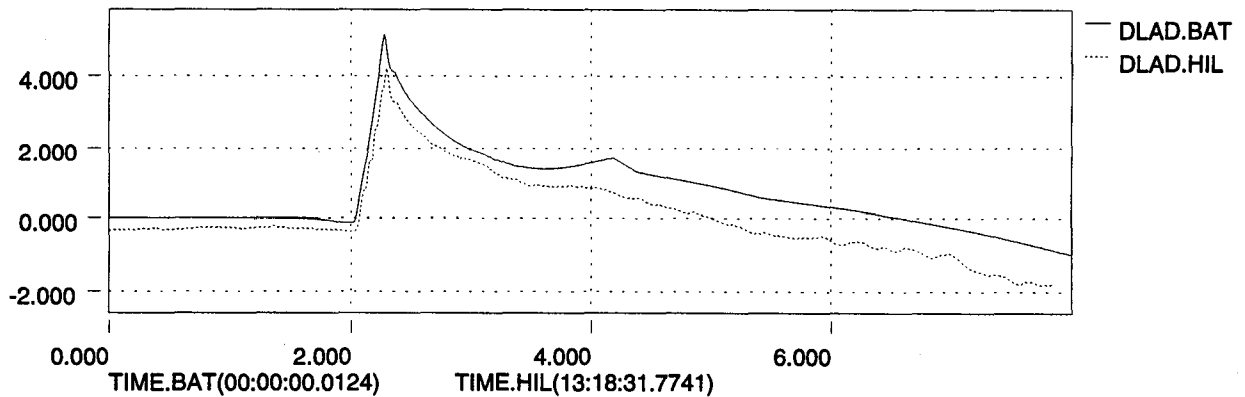
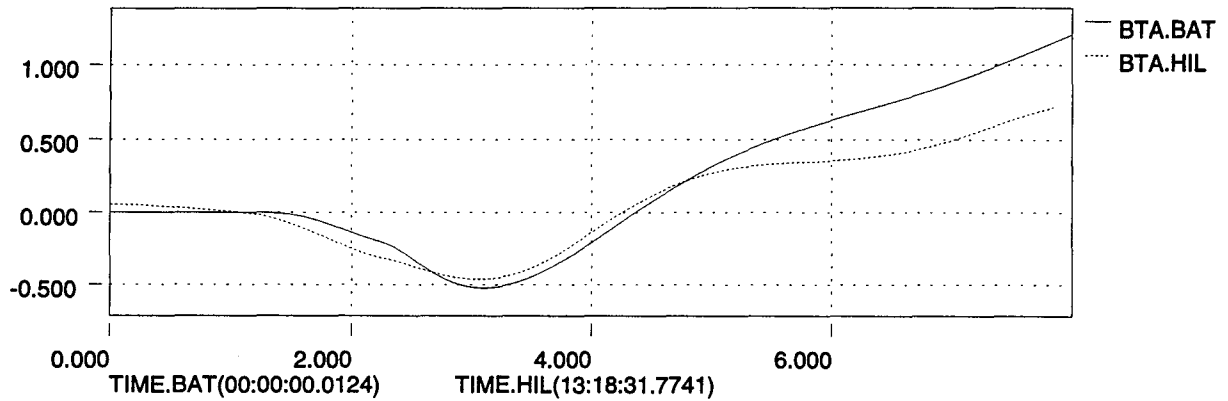
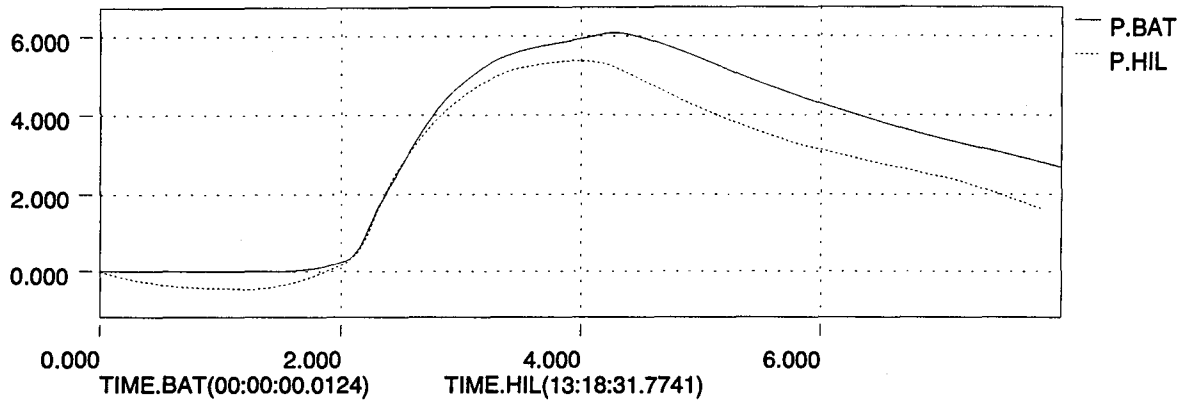
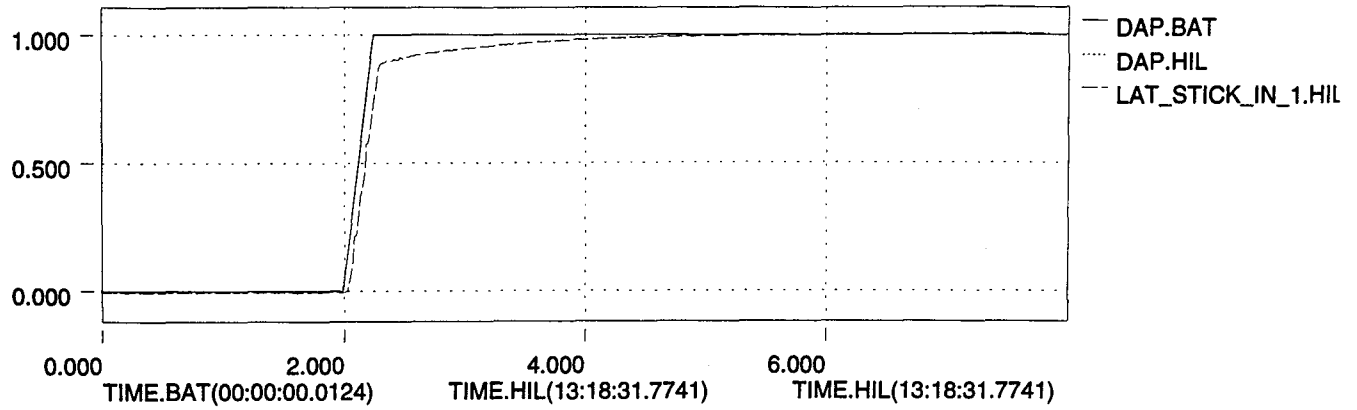




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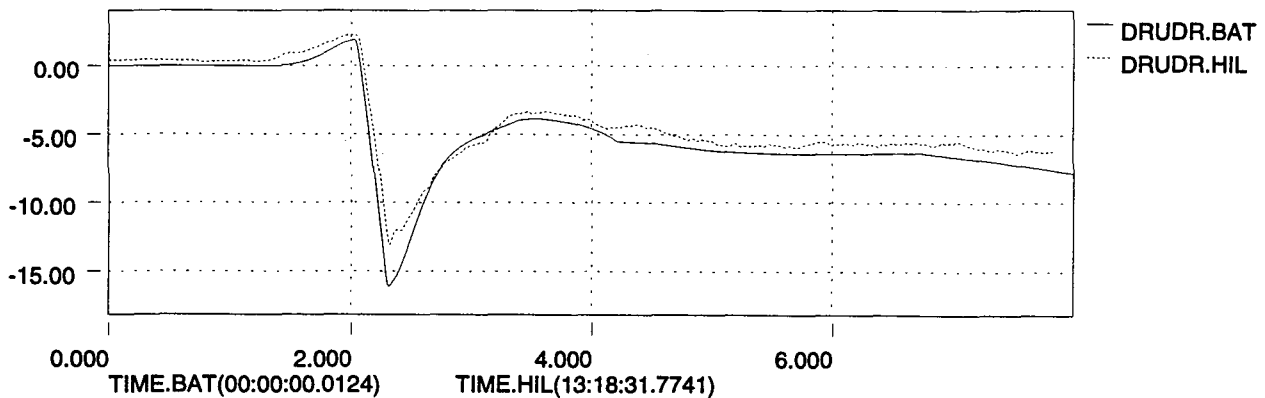
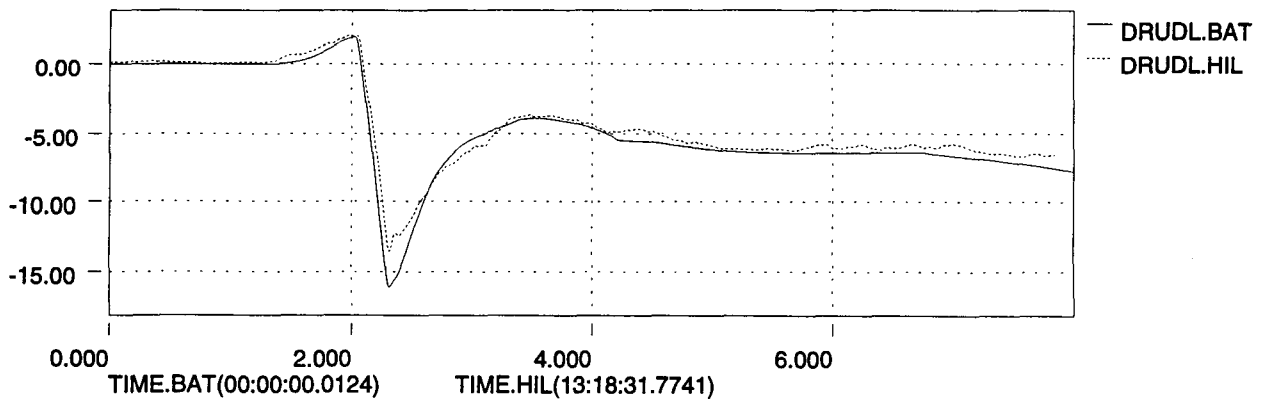
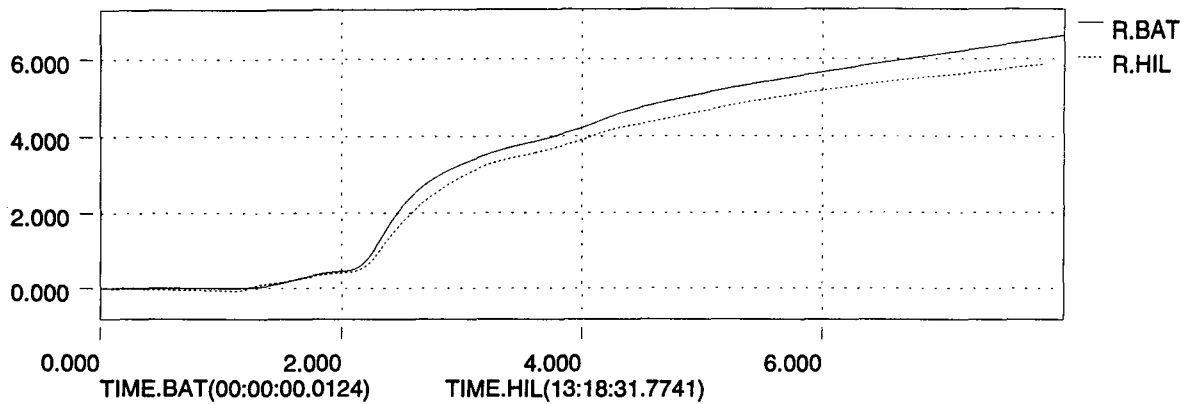
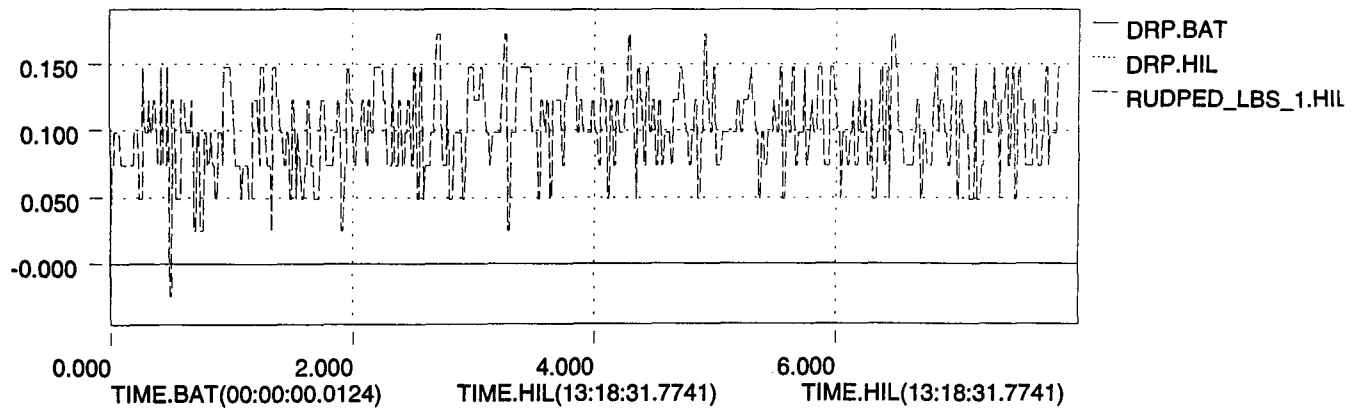
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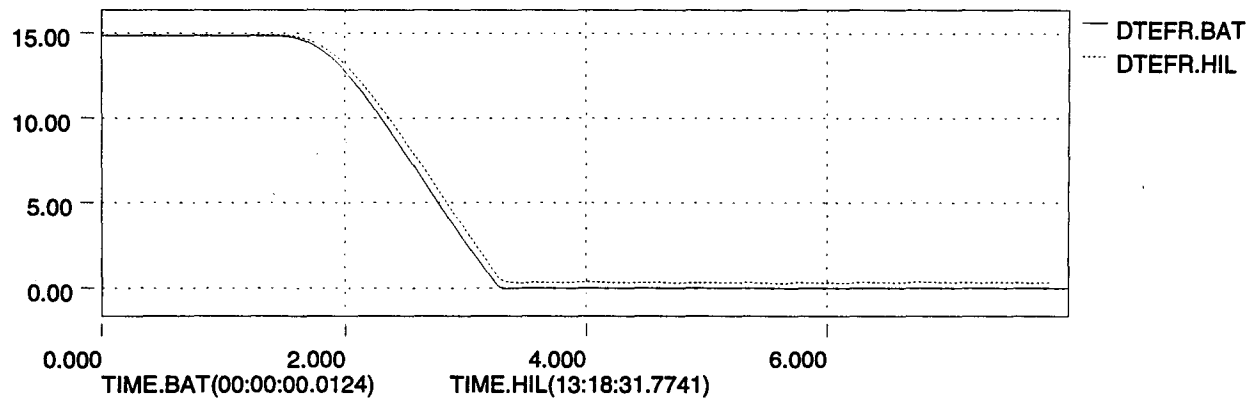
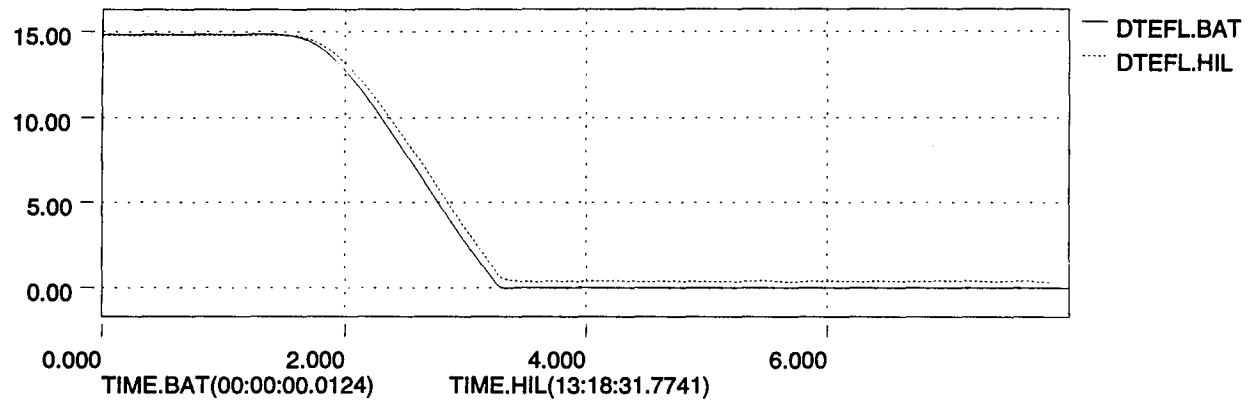
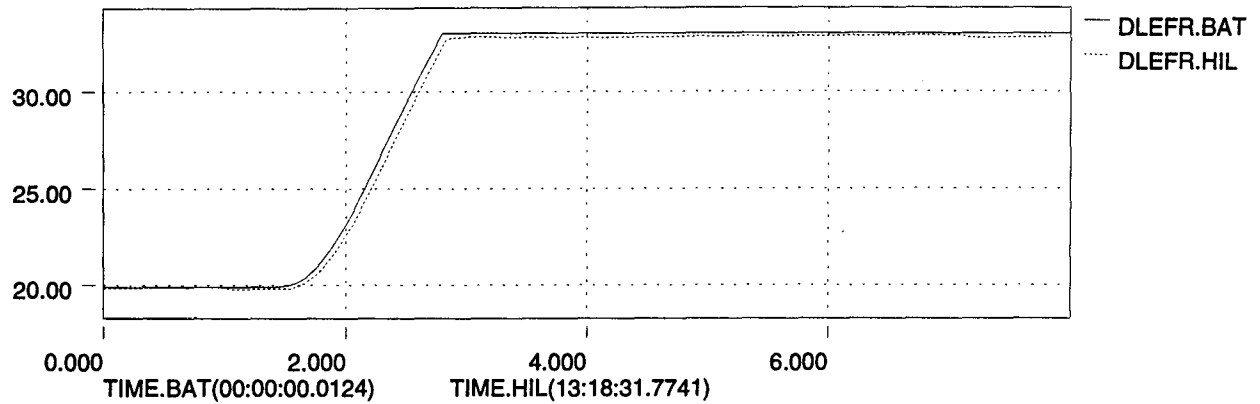
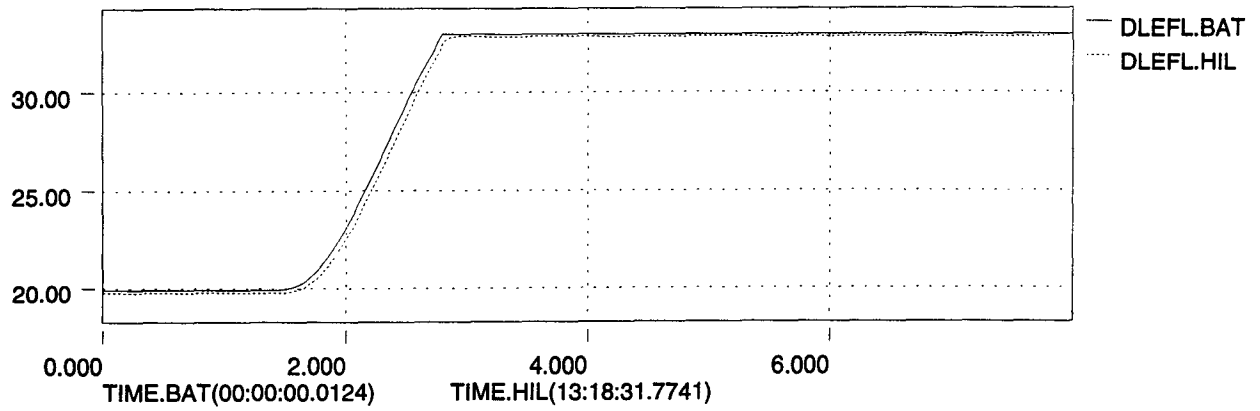
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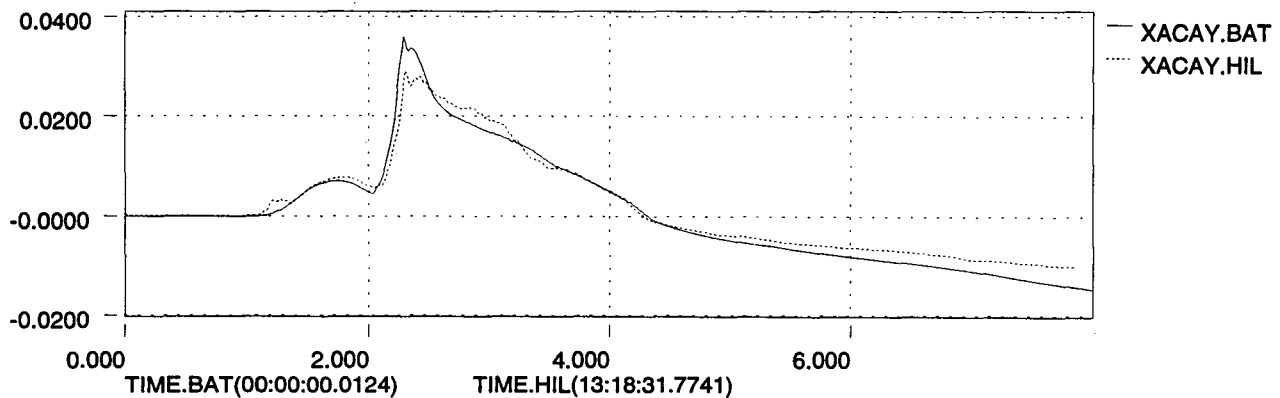
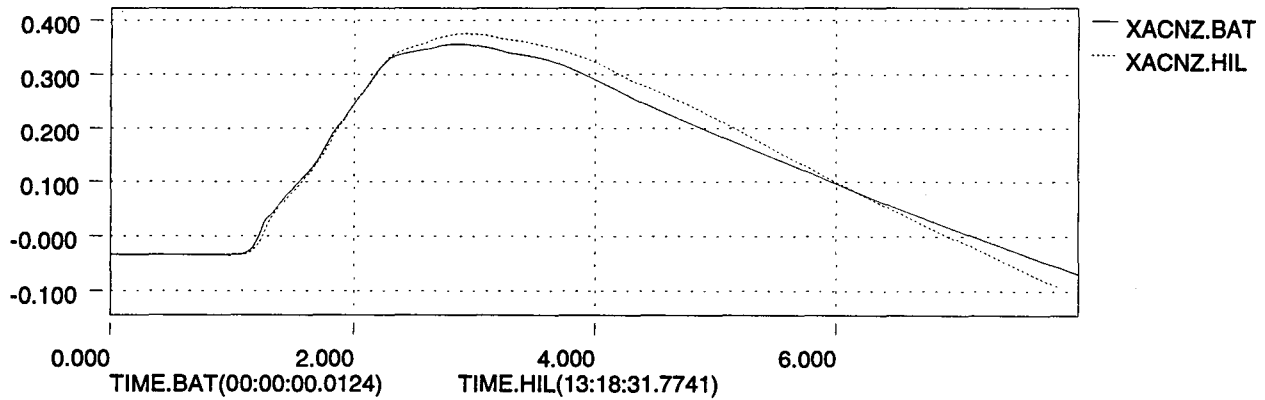
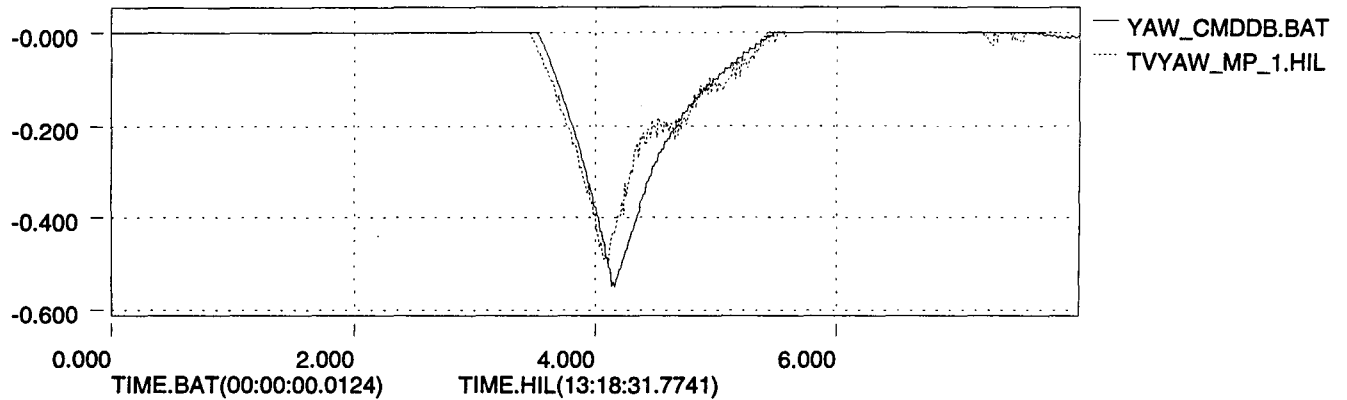
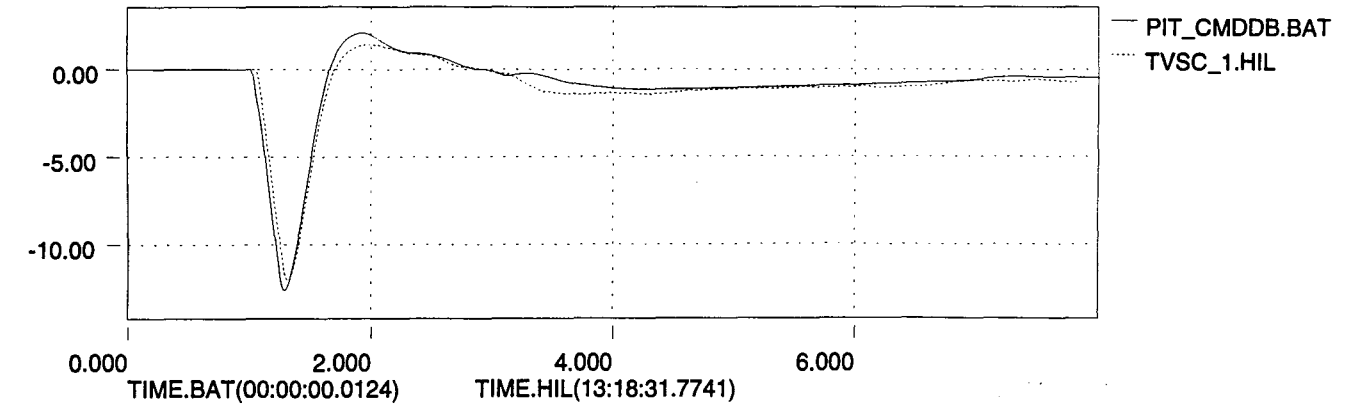
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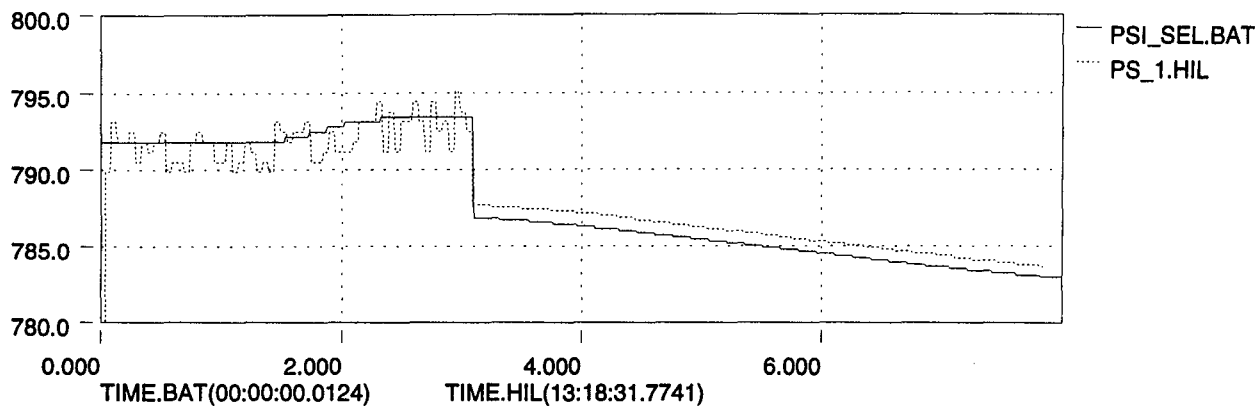
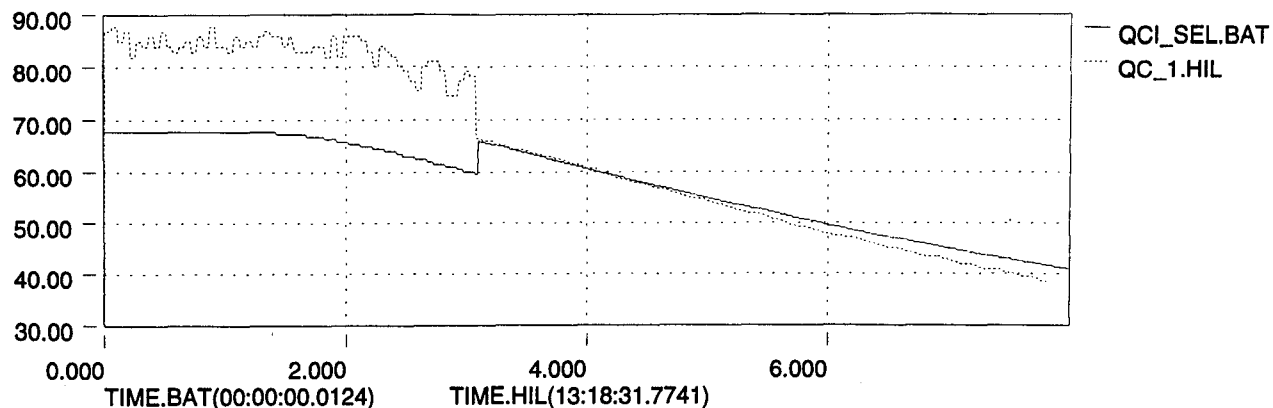
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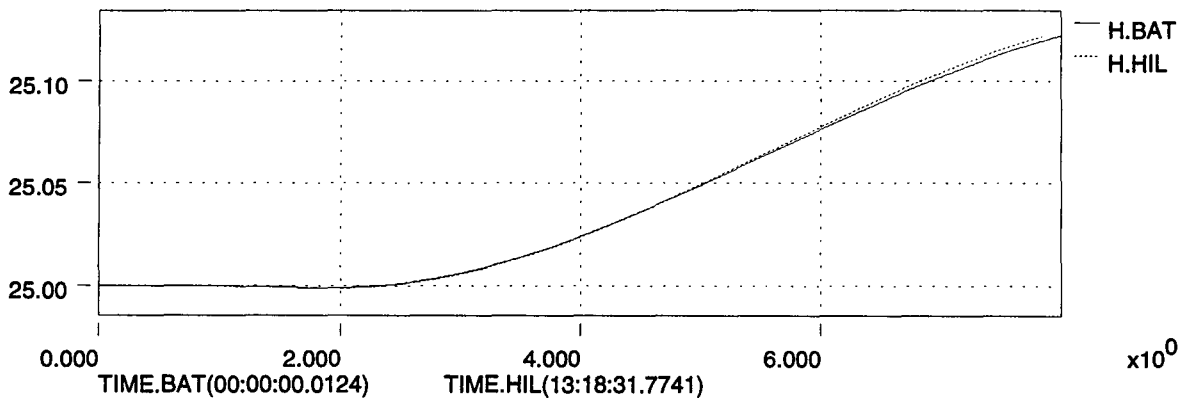


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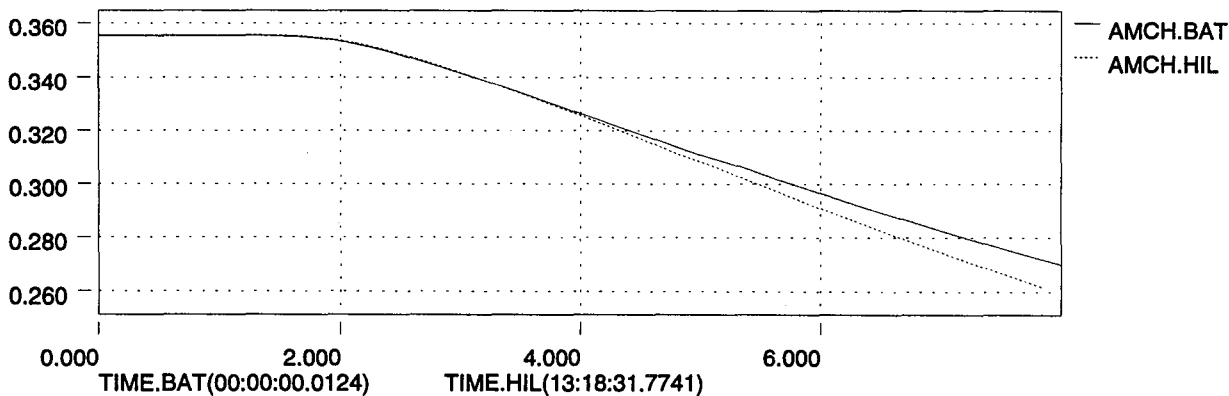
463



$\times 10^3$

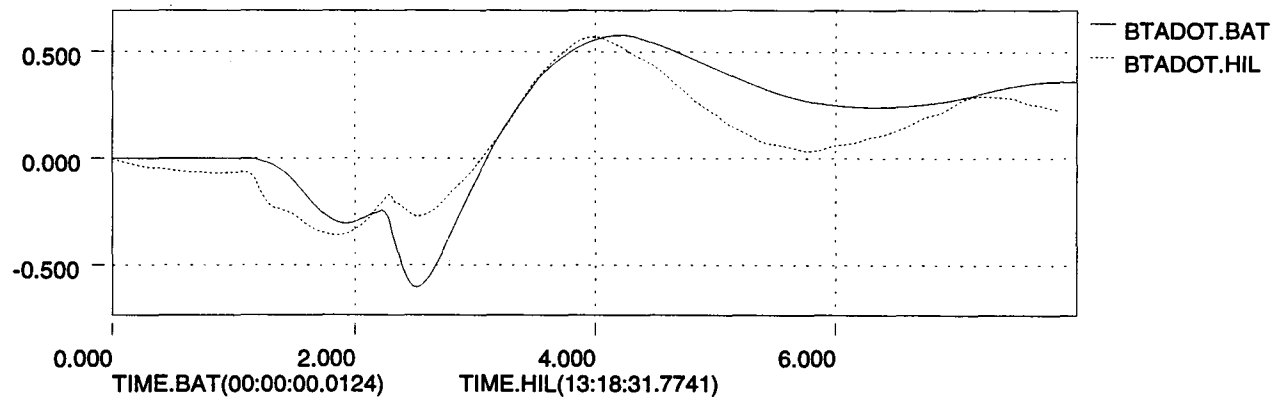
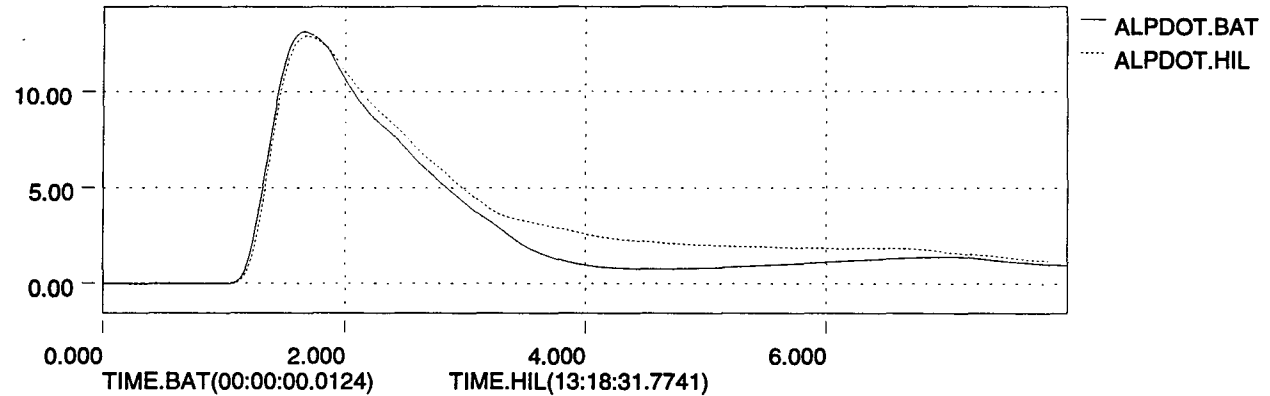
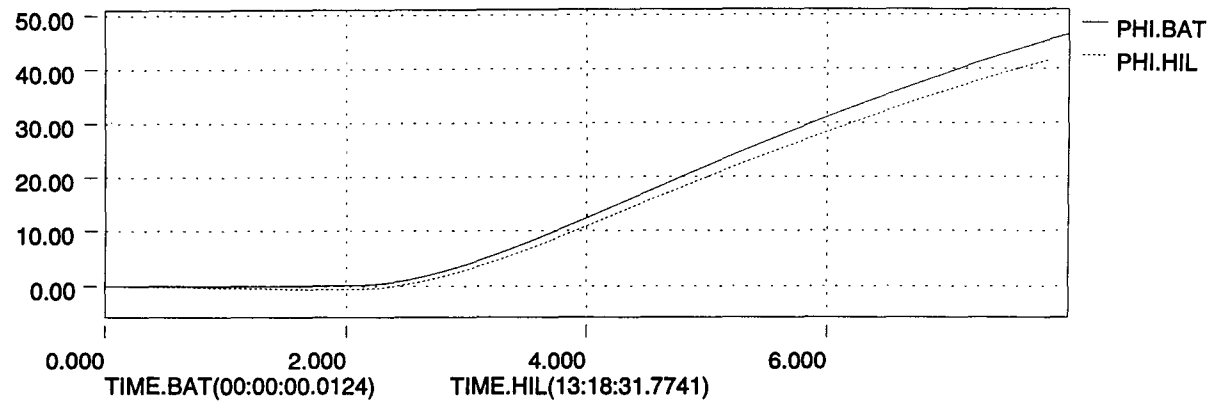
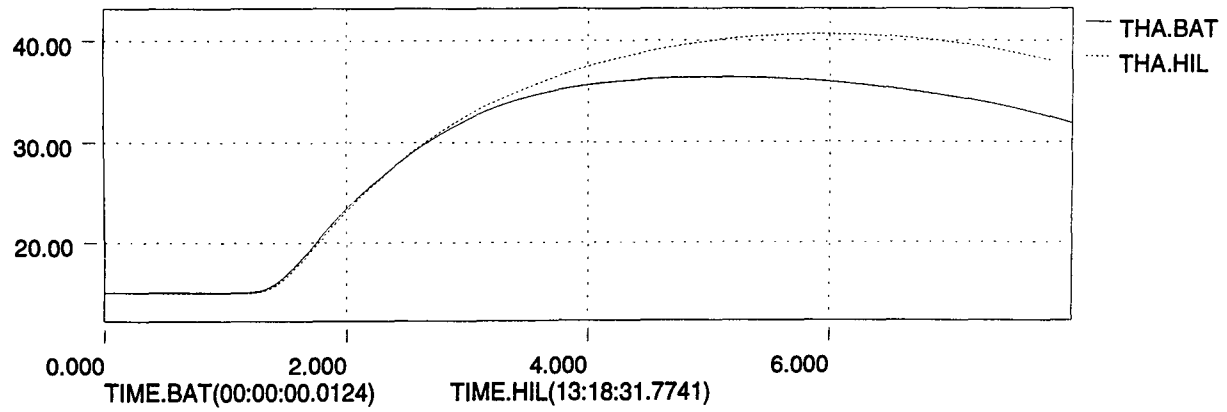


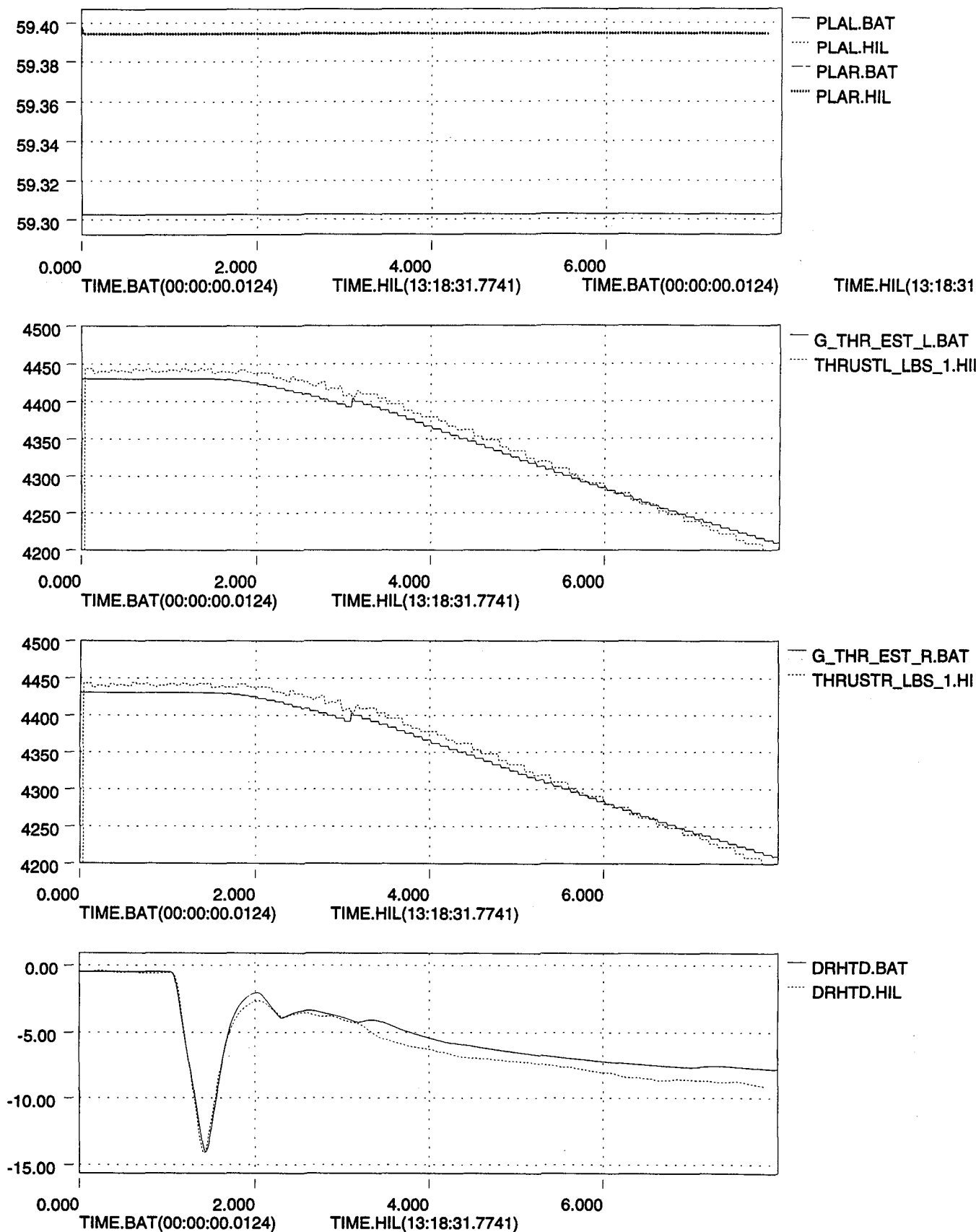
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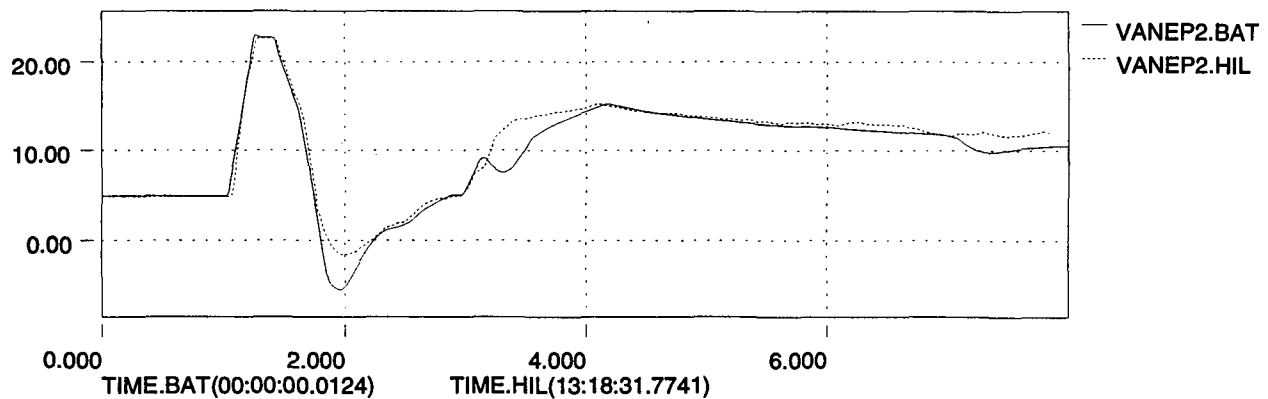
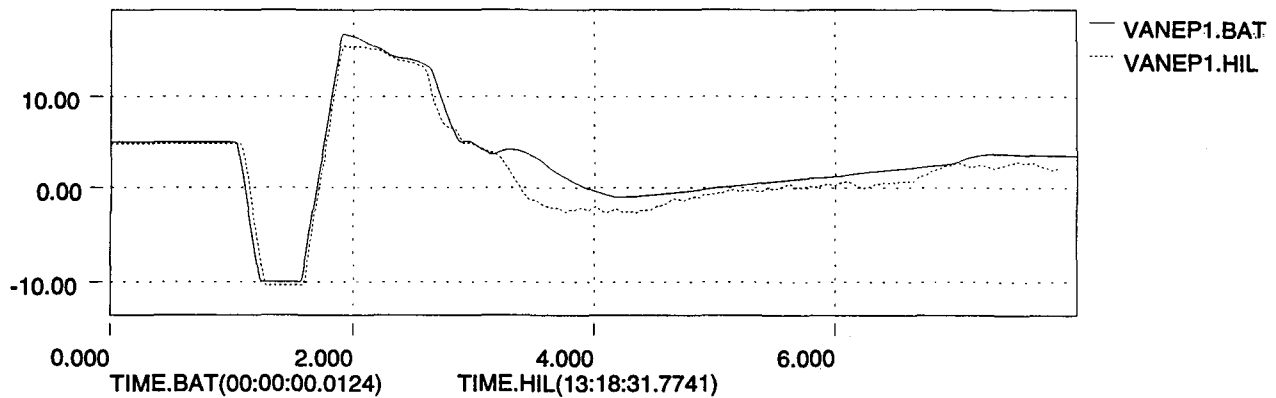
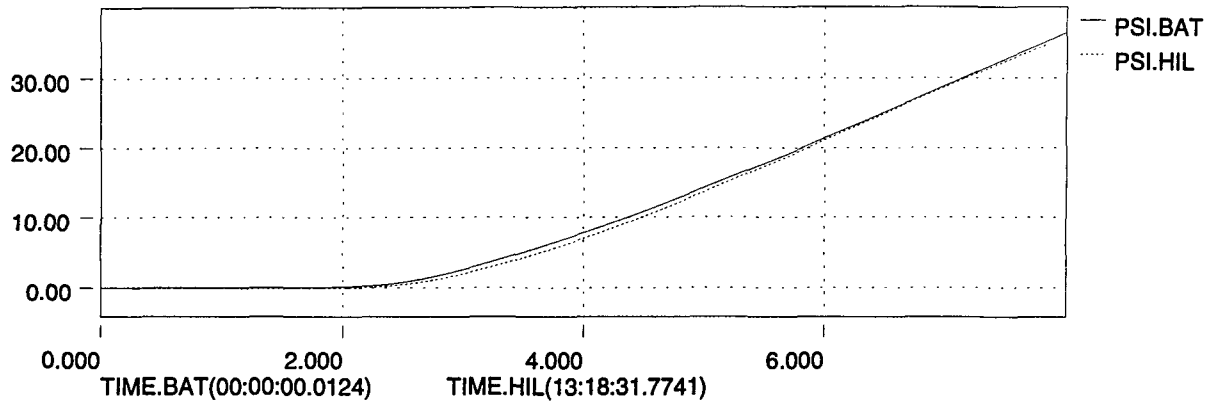
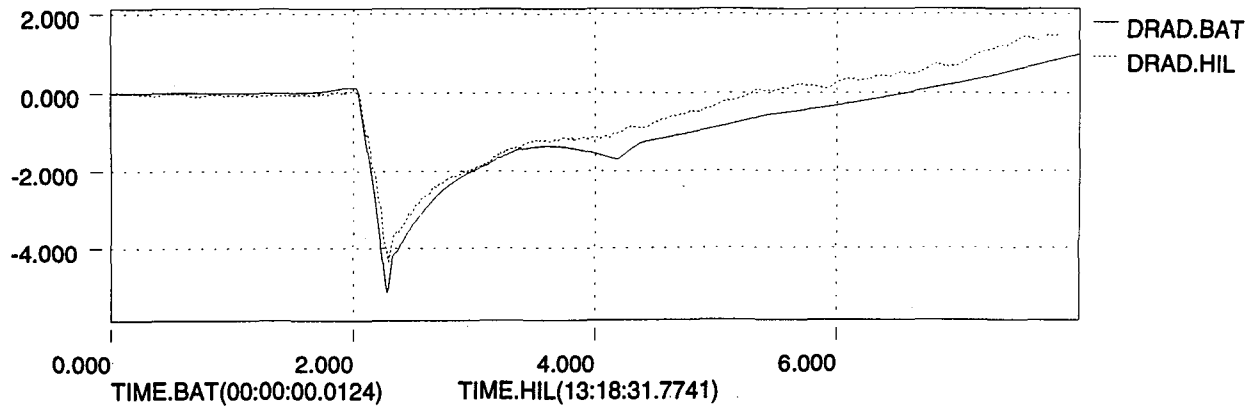
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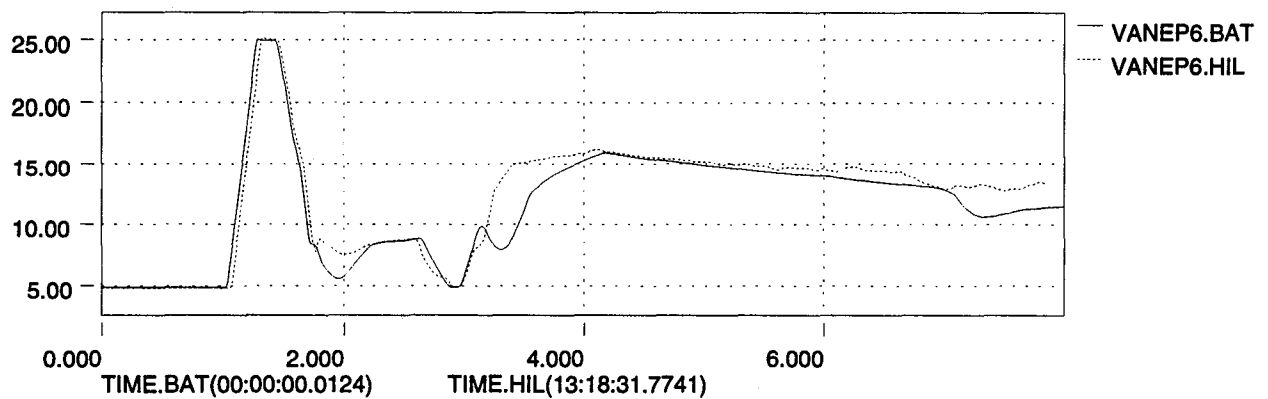
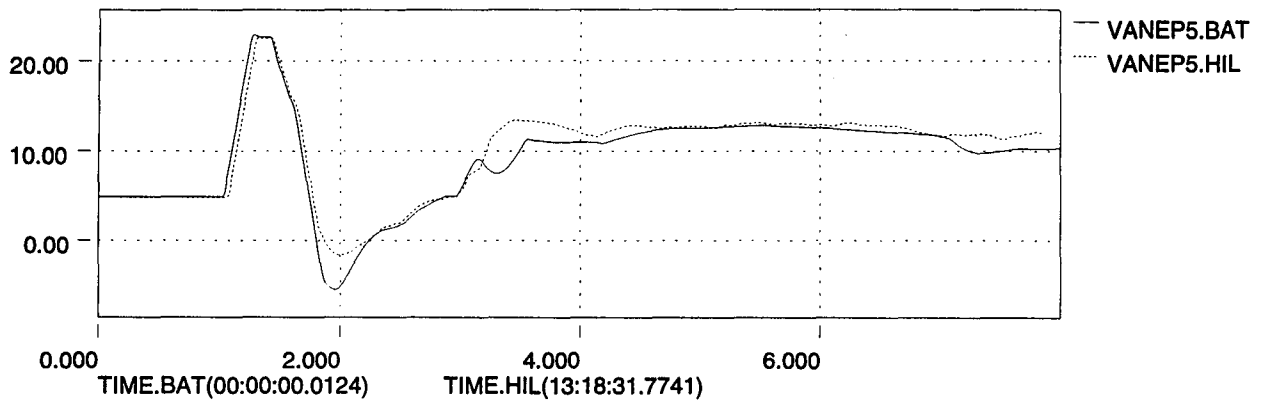
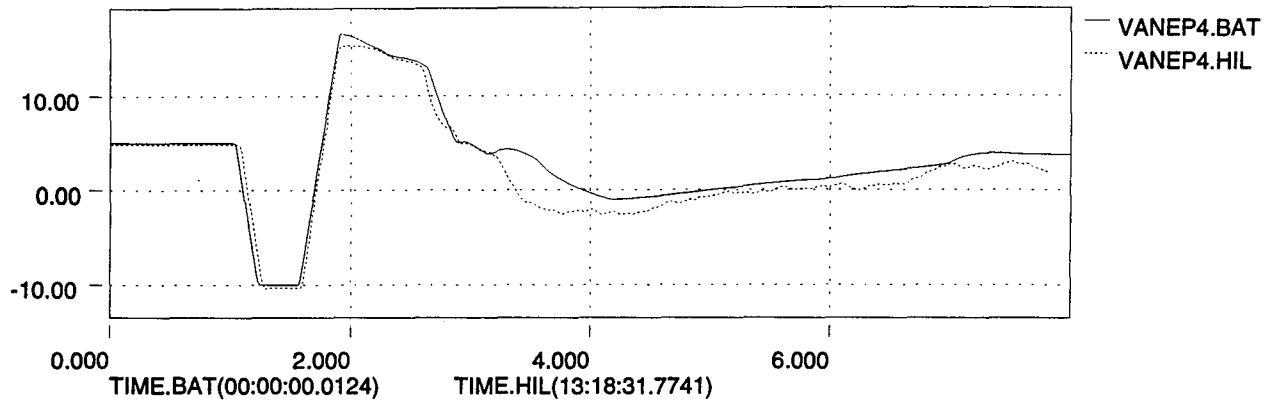
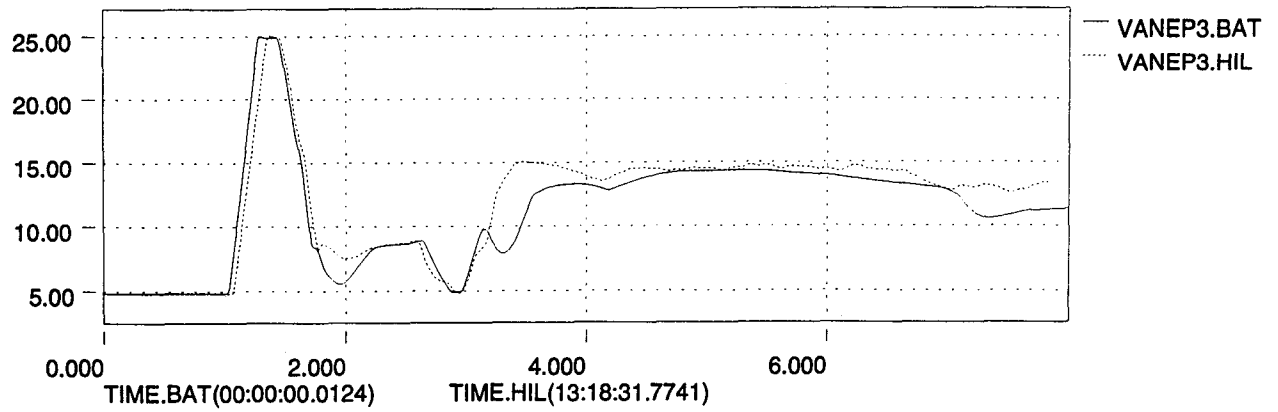
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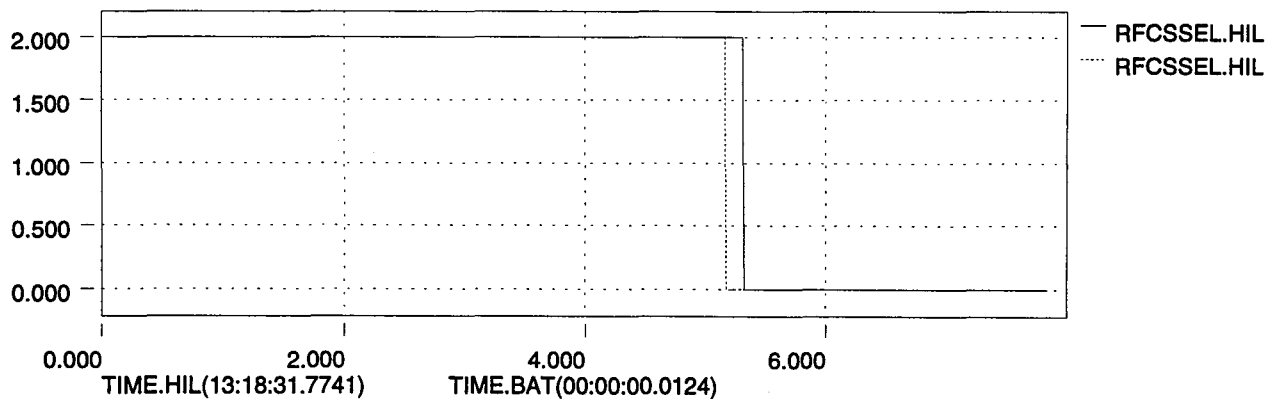
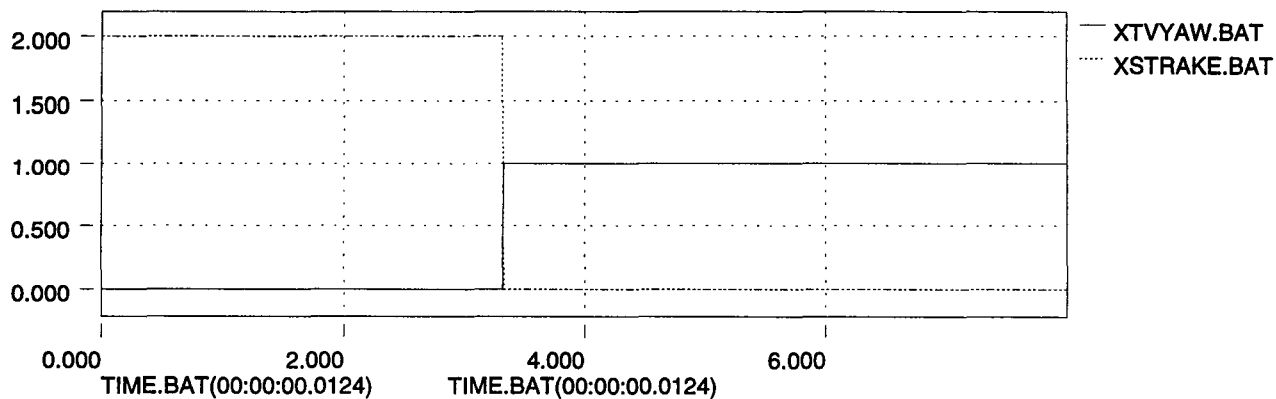
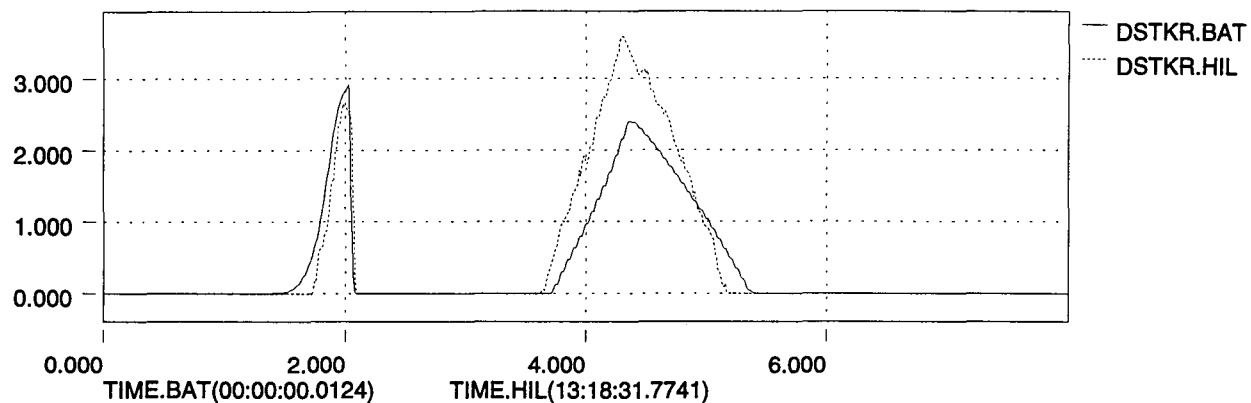
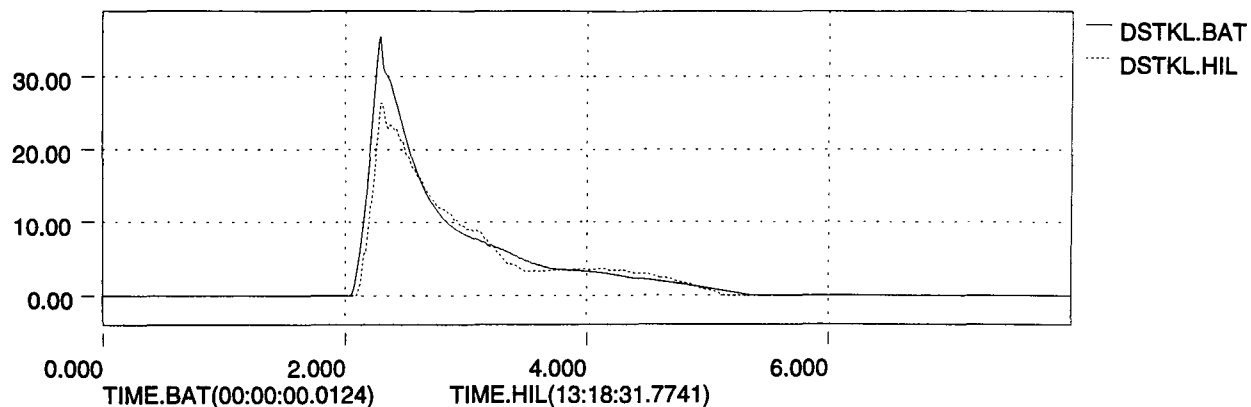
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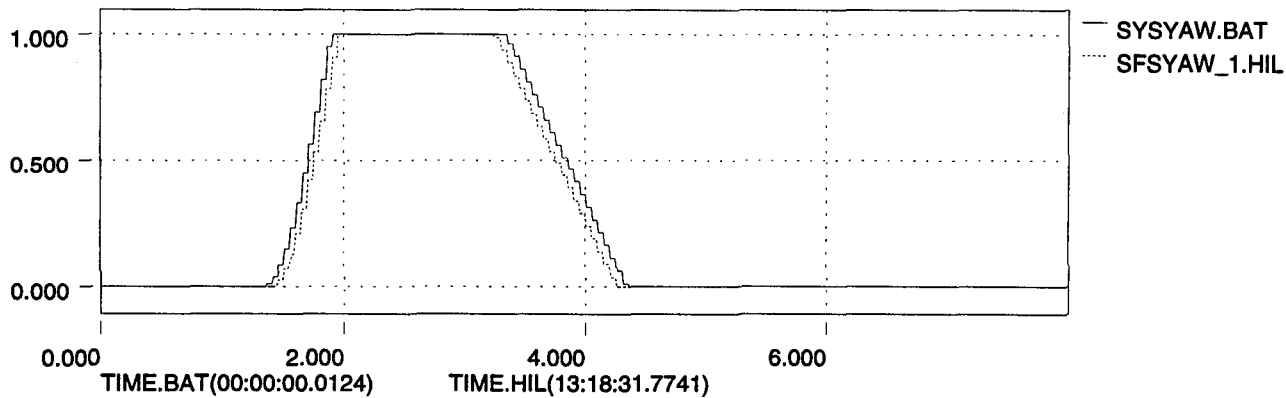
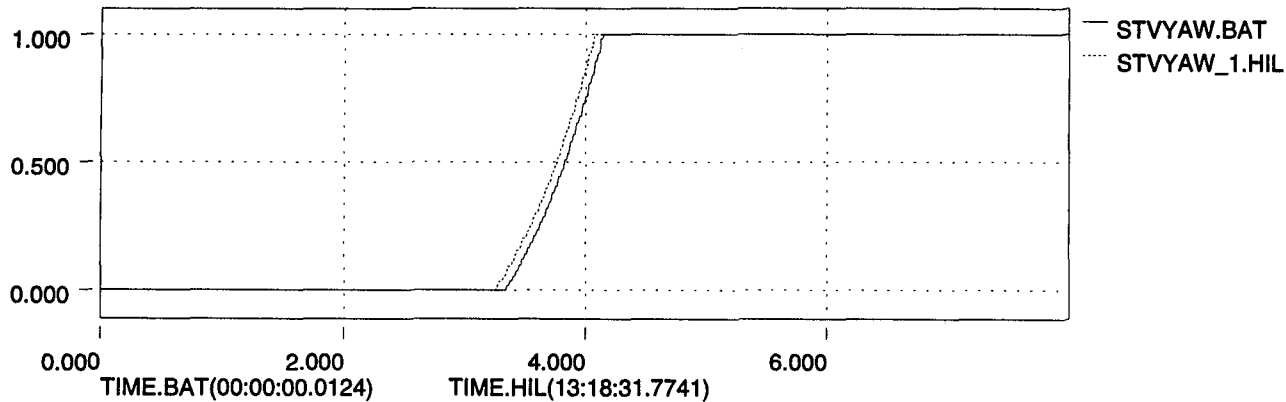
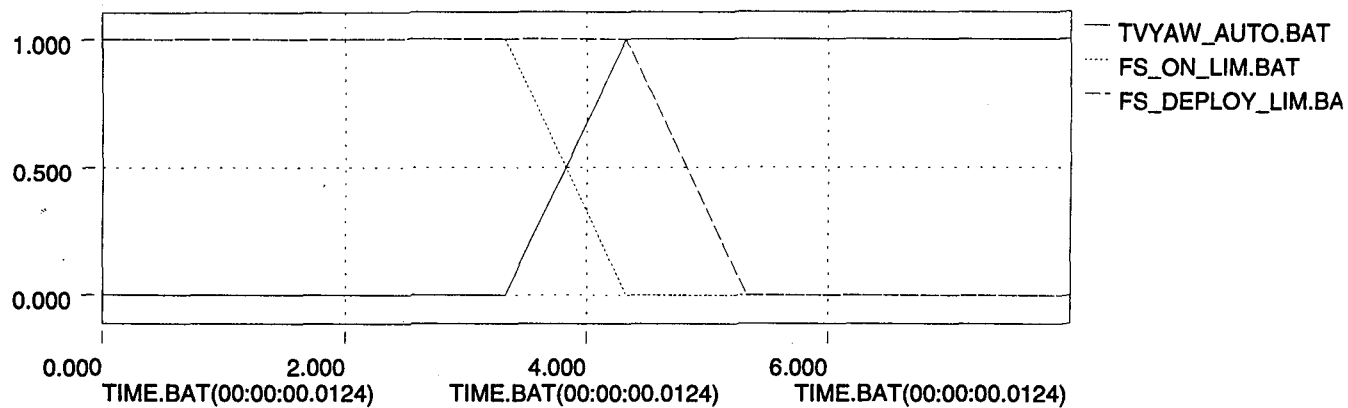
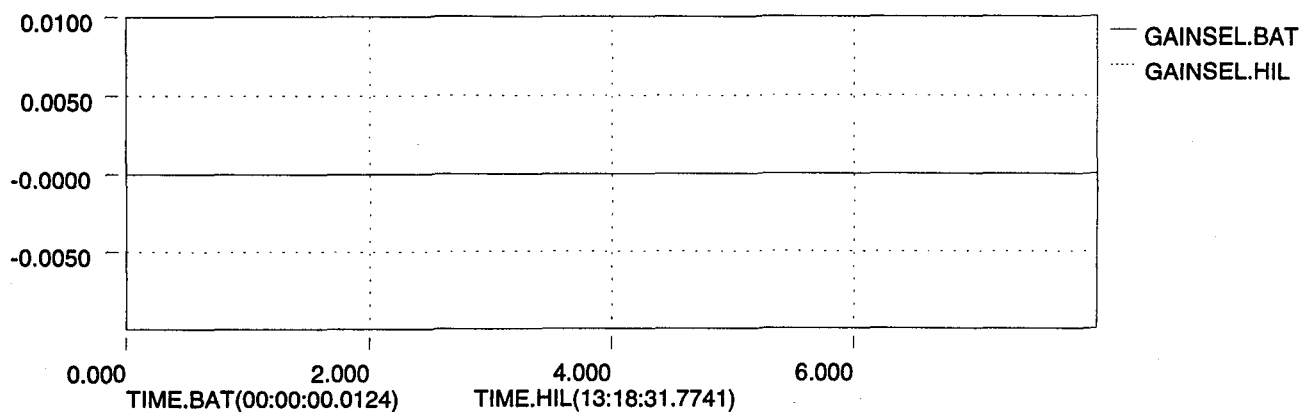
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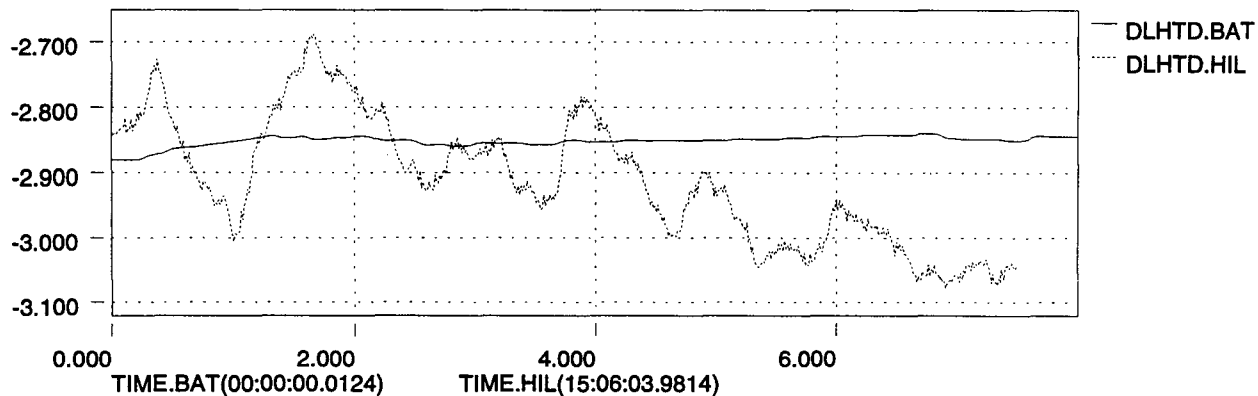
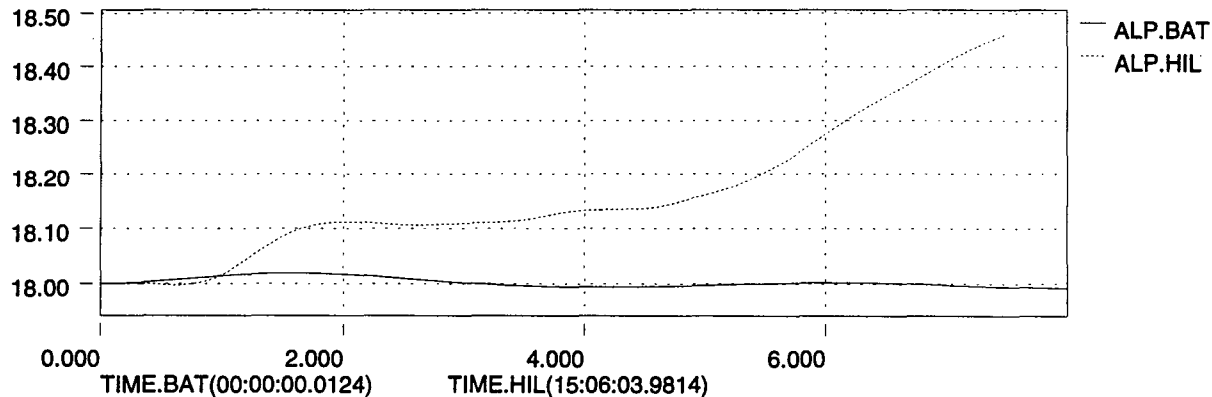
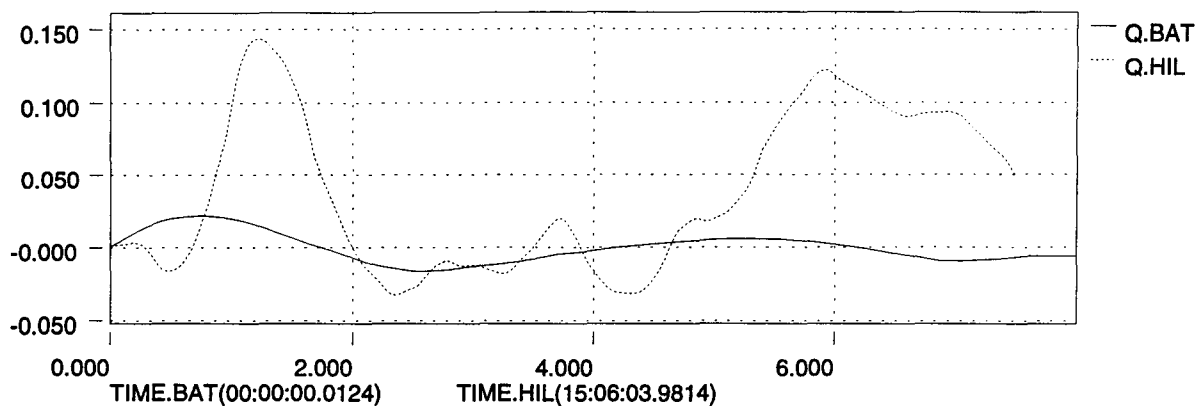
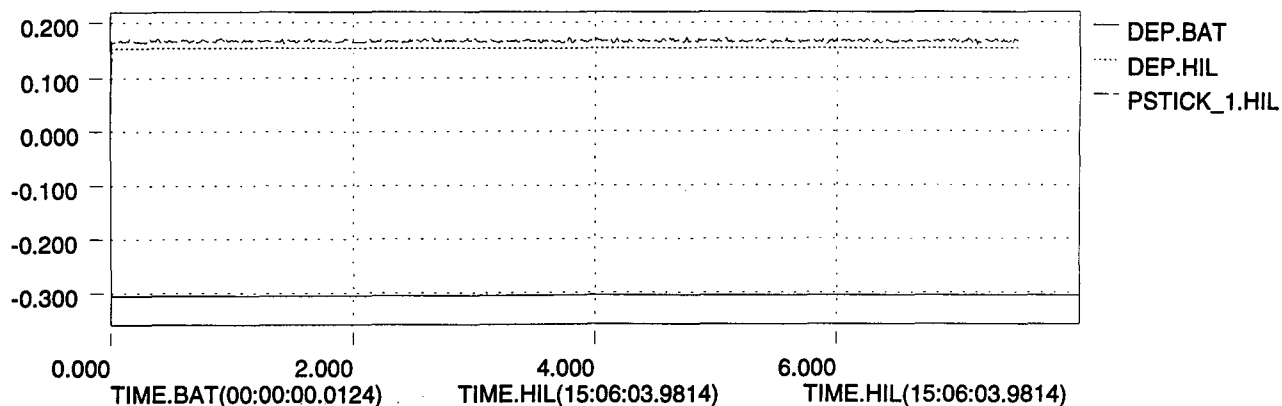
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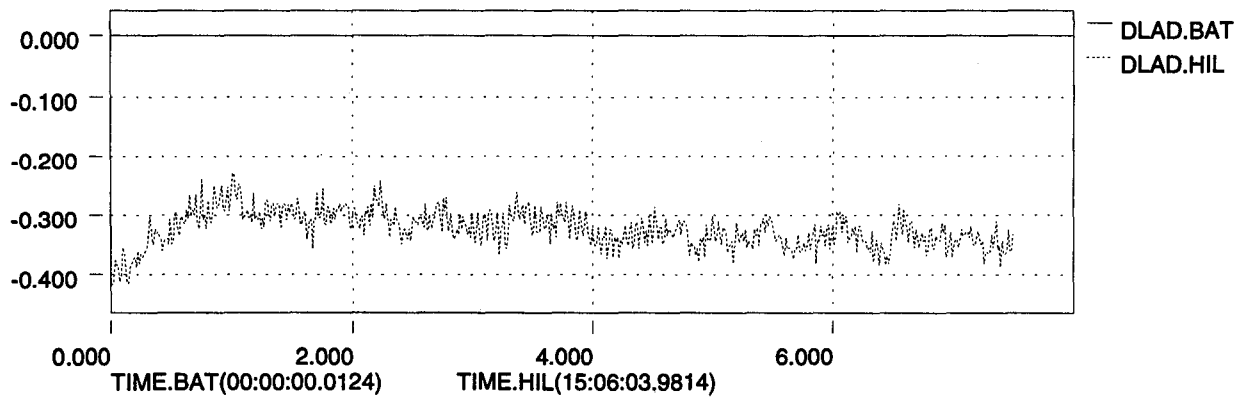
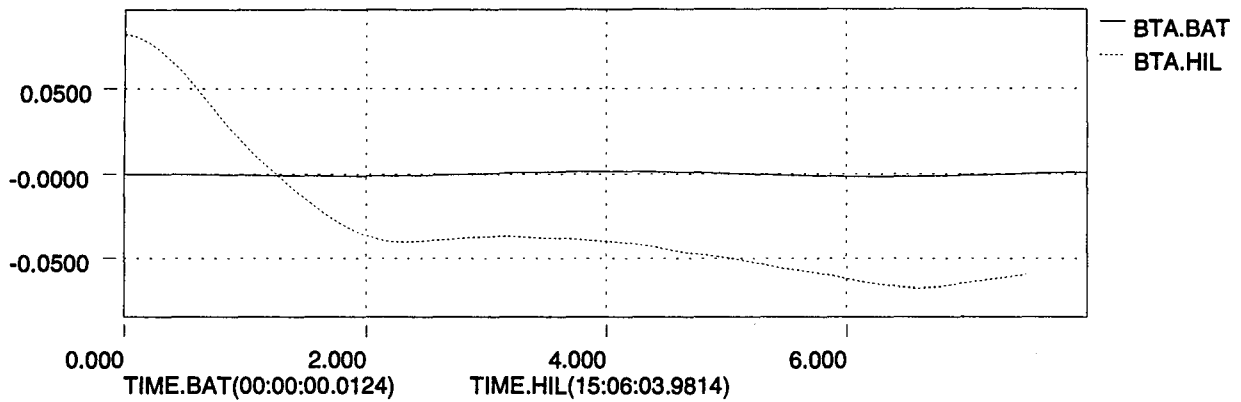
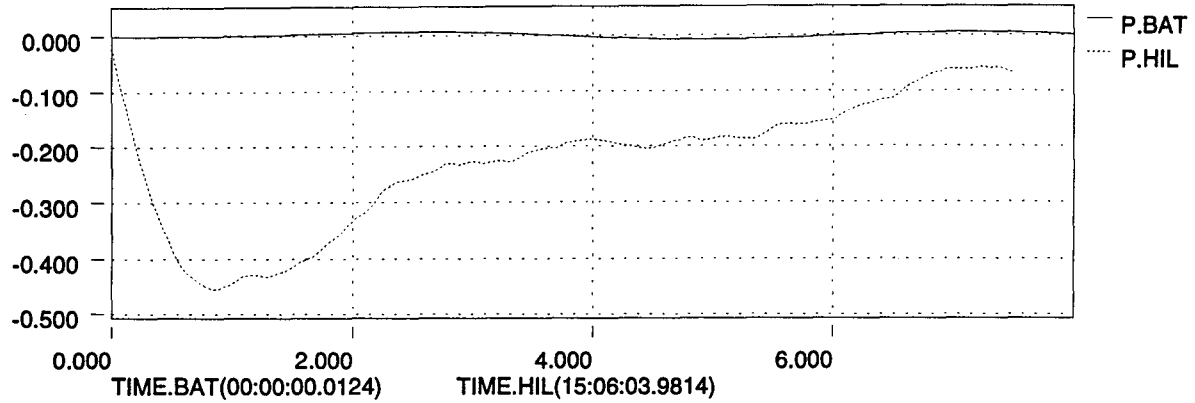
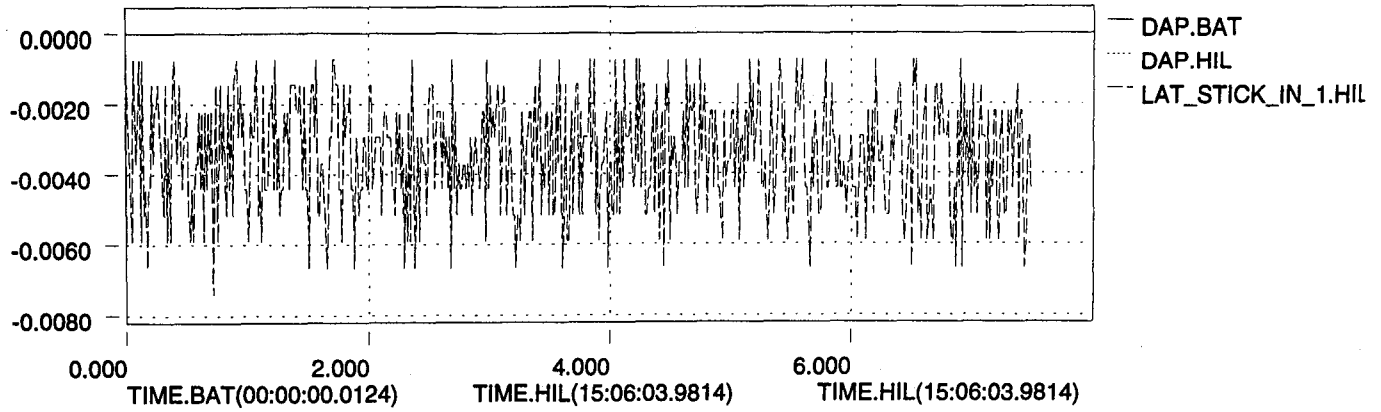
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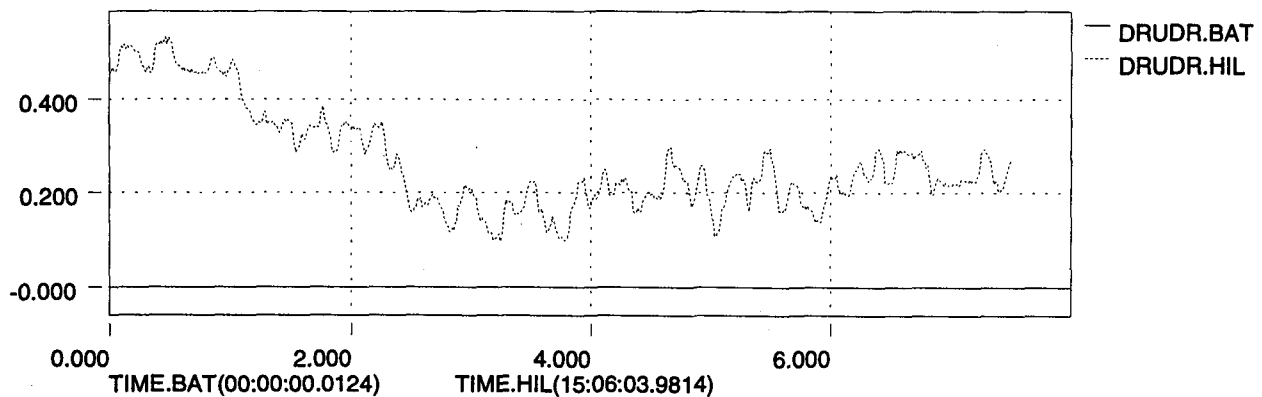
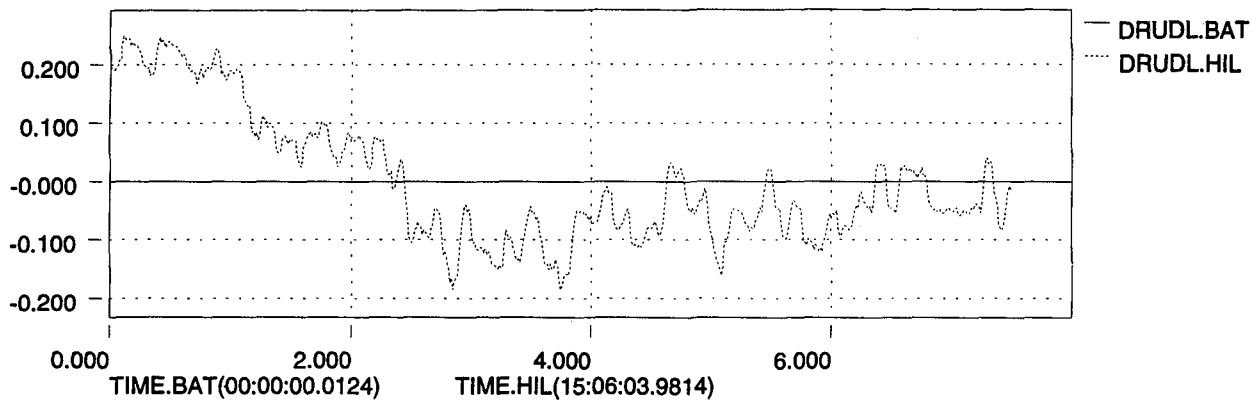
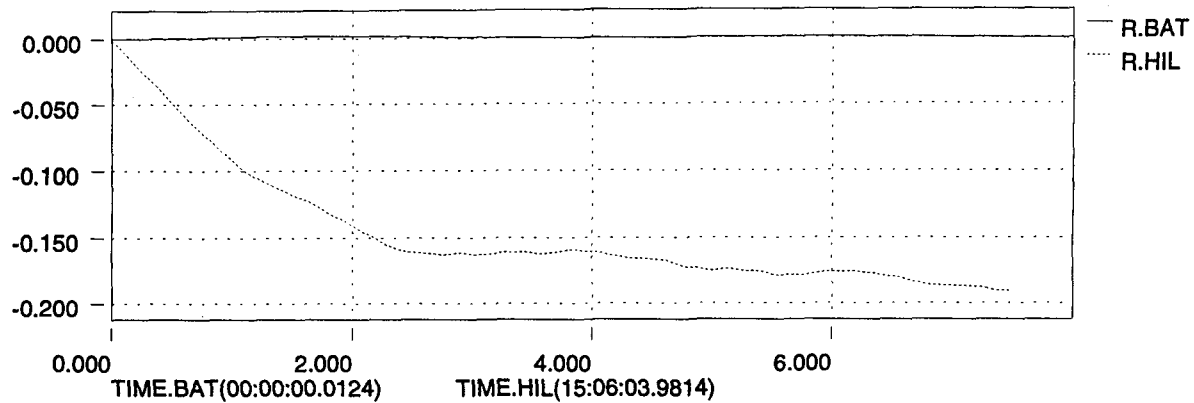
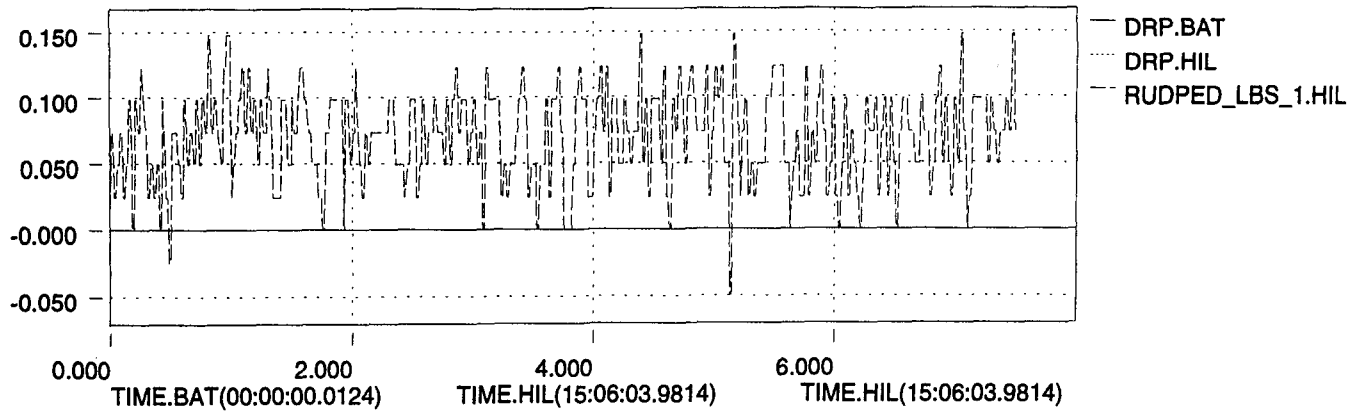
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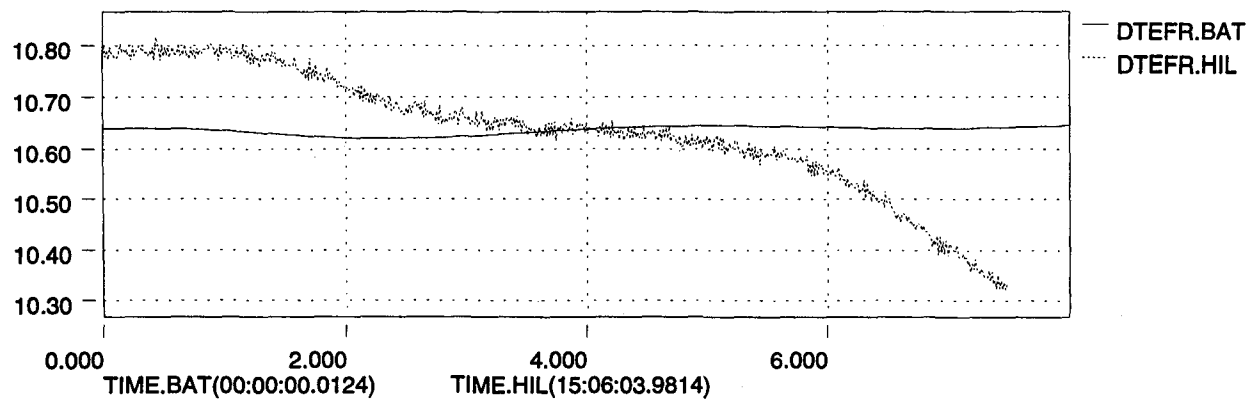
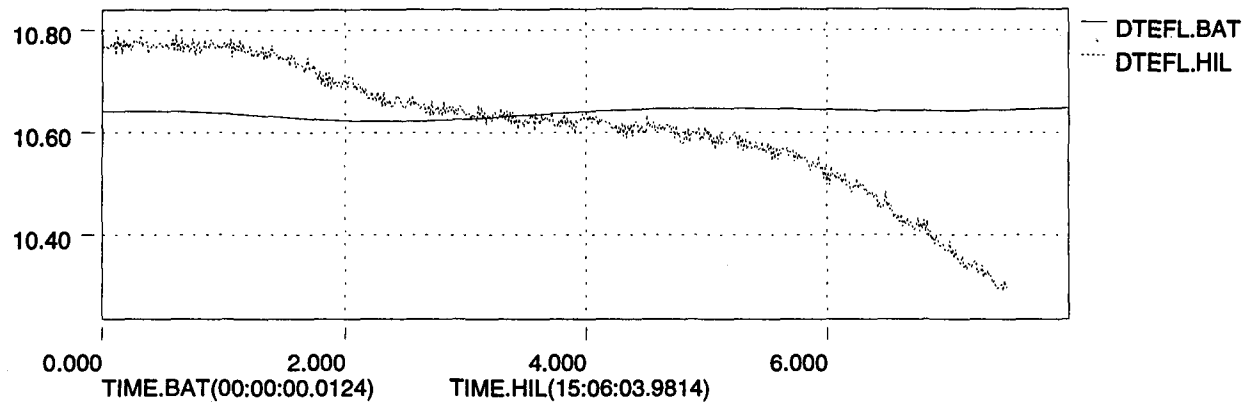
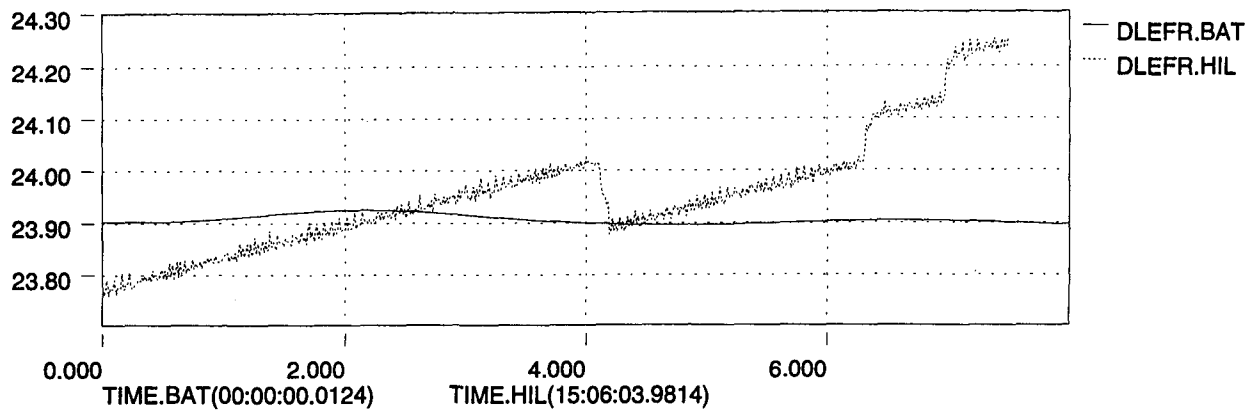
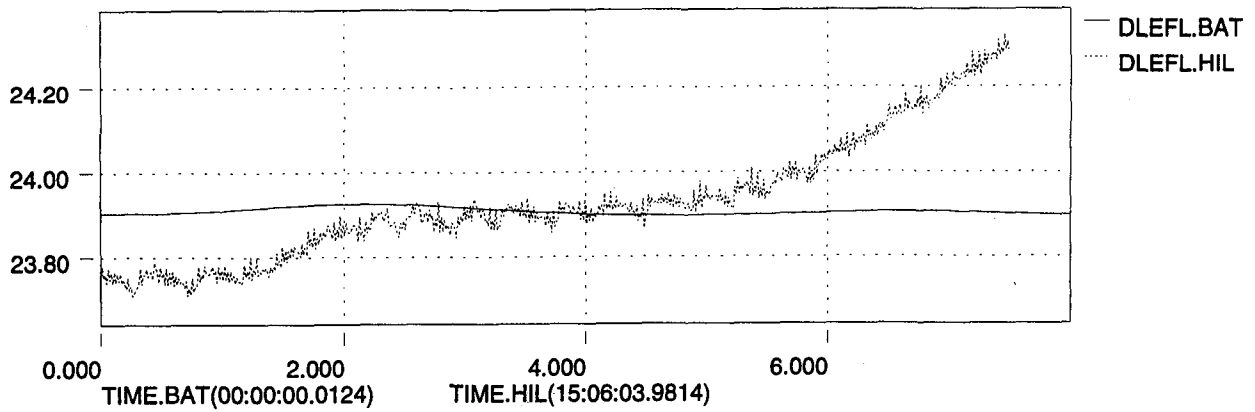
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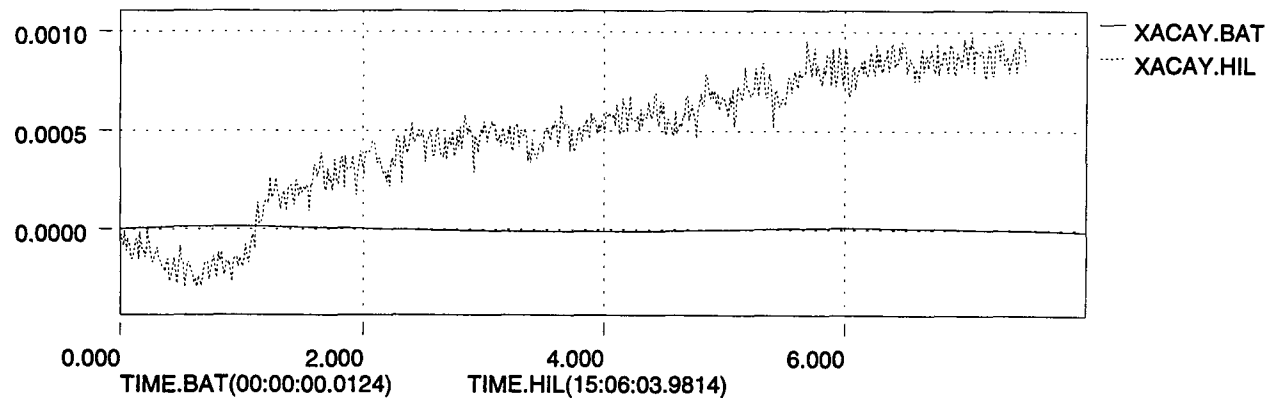
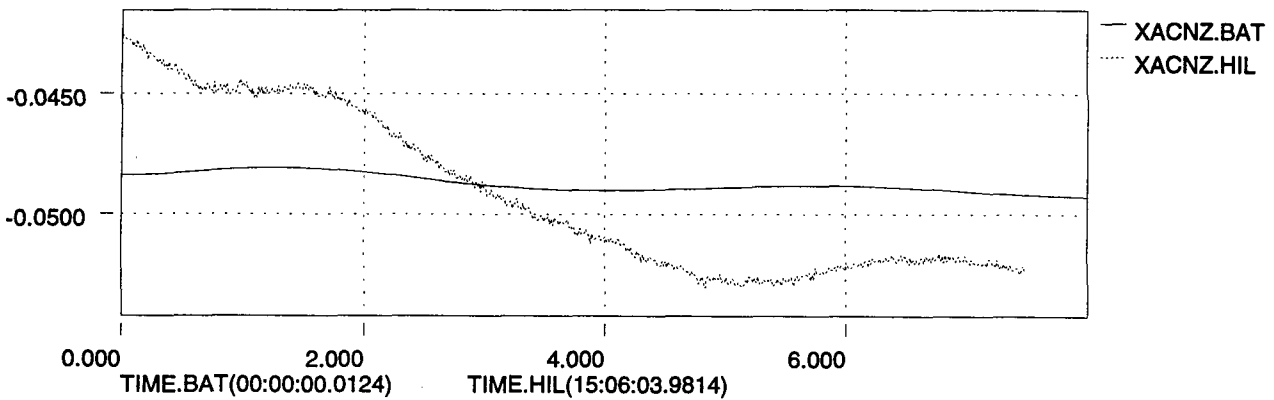
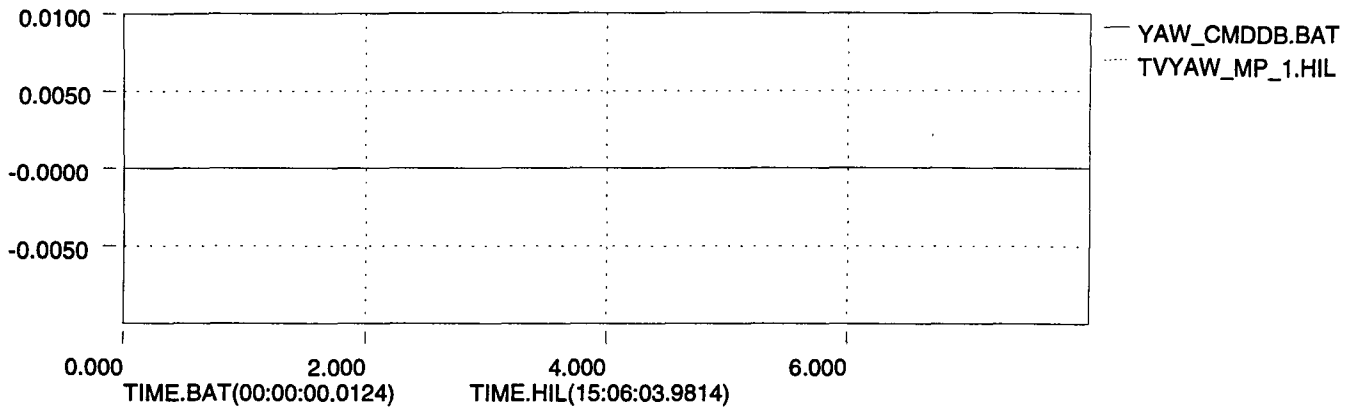
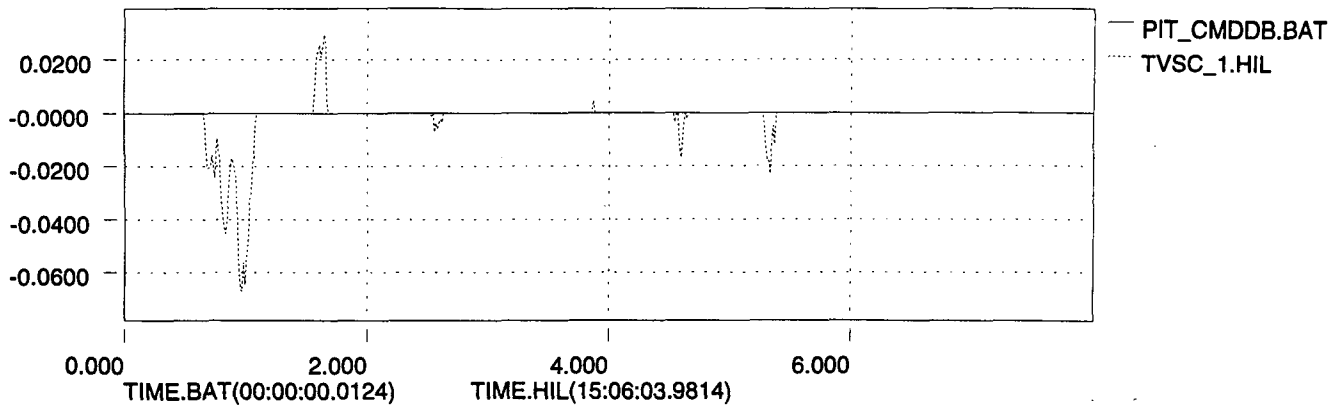
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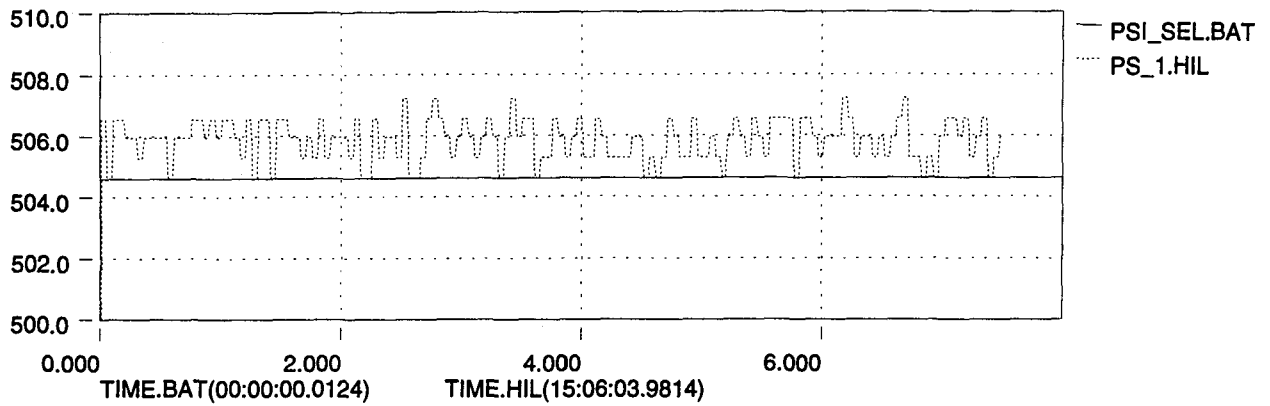
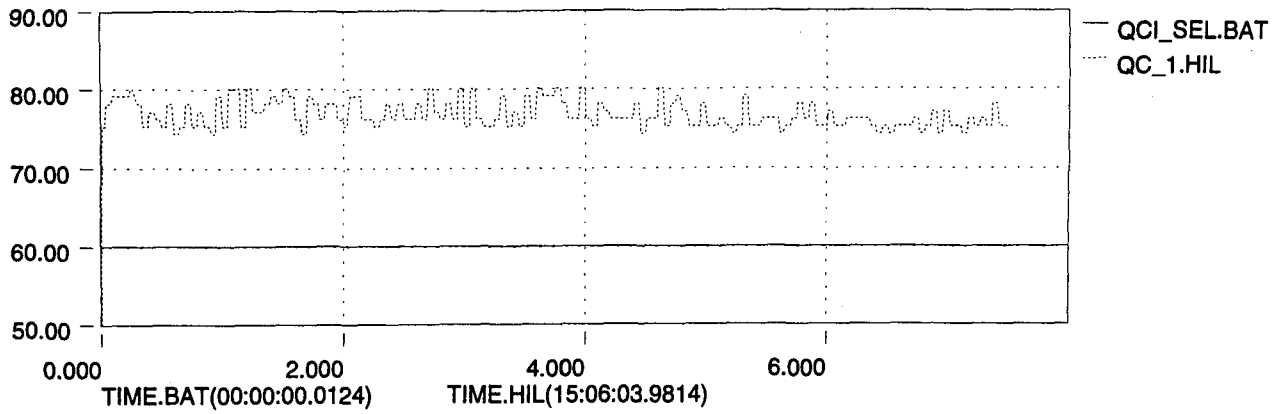
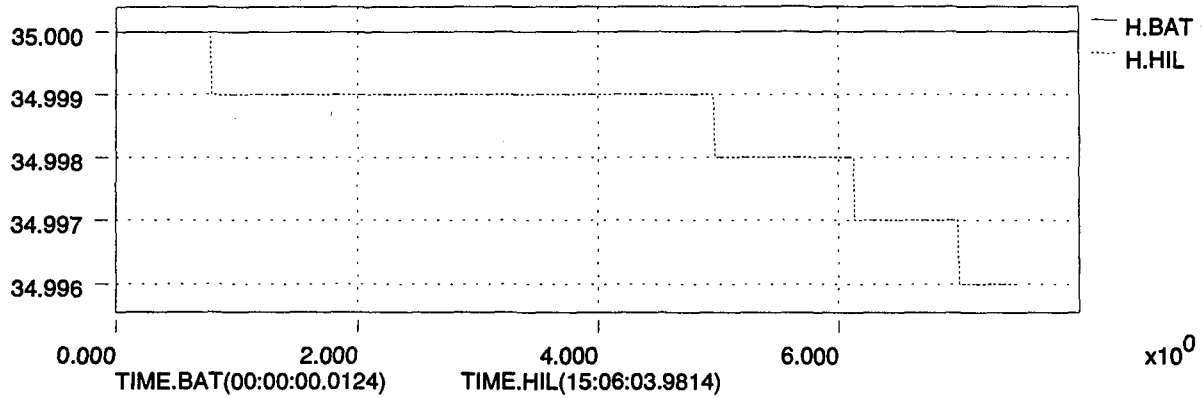
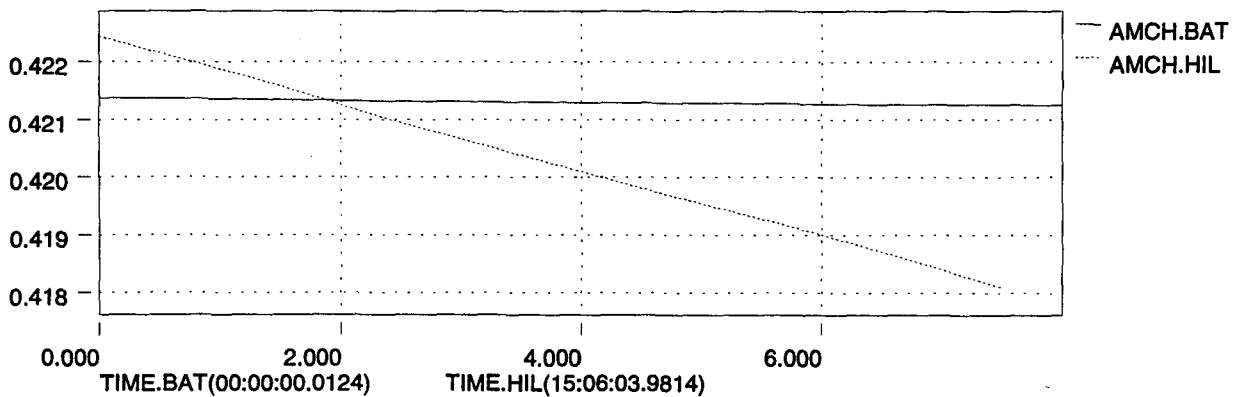
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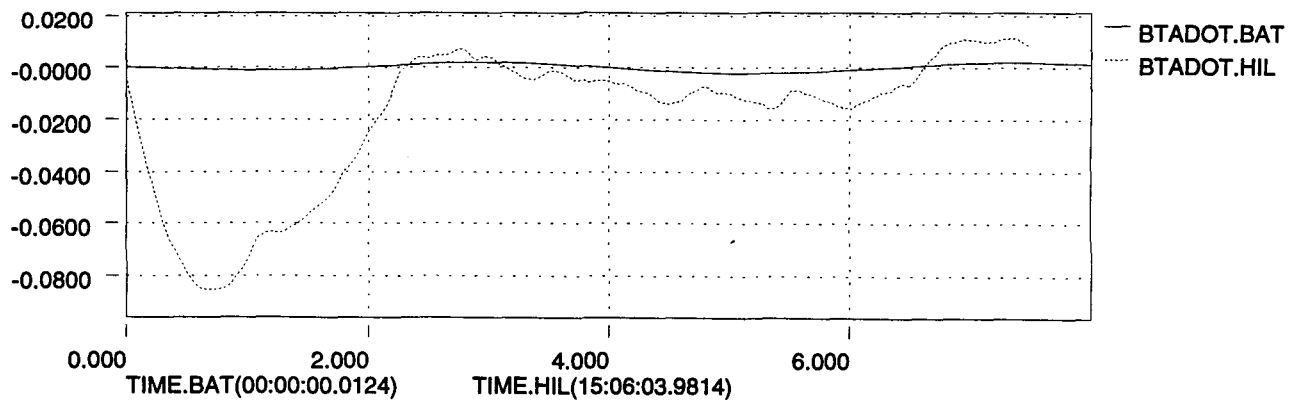
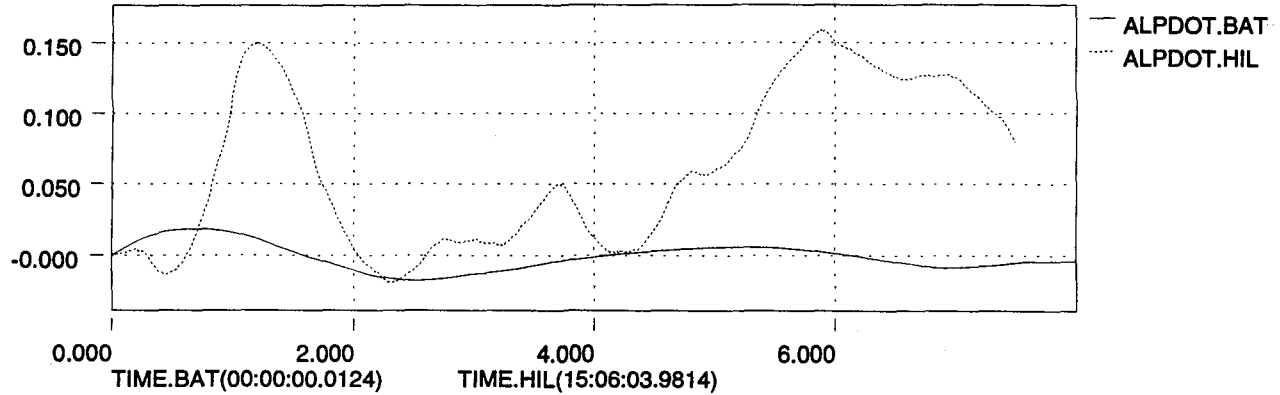
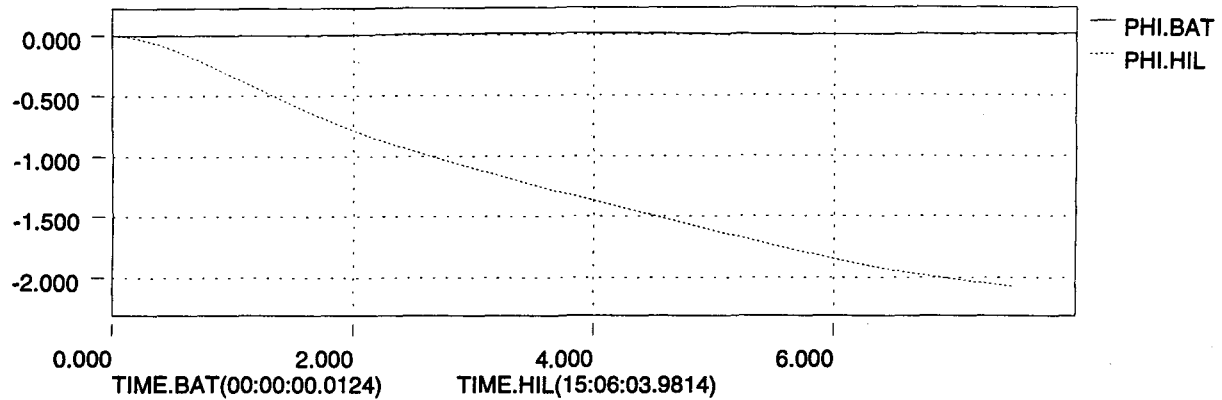
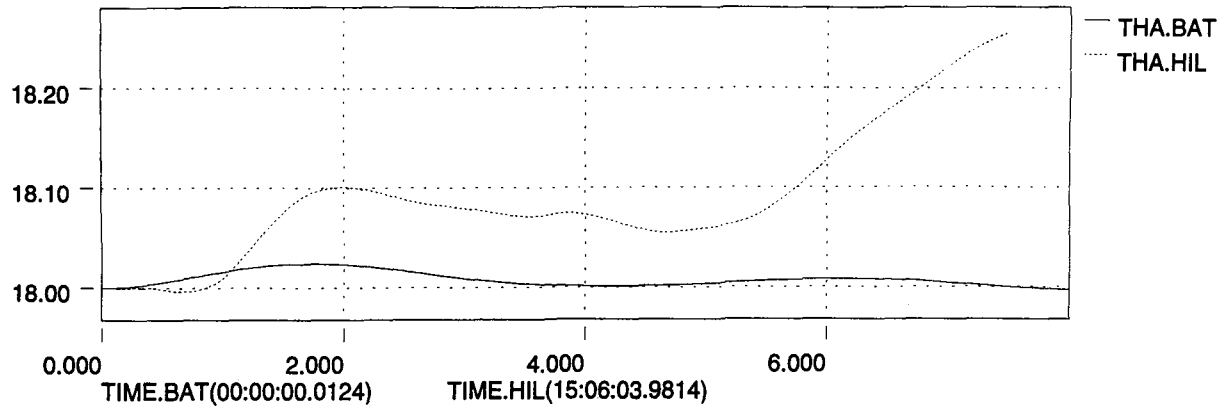
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 $\times 10^3$  $\times 10^0$ 

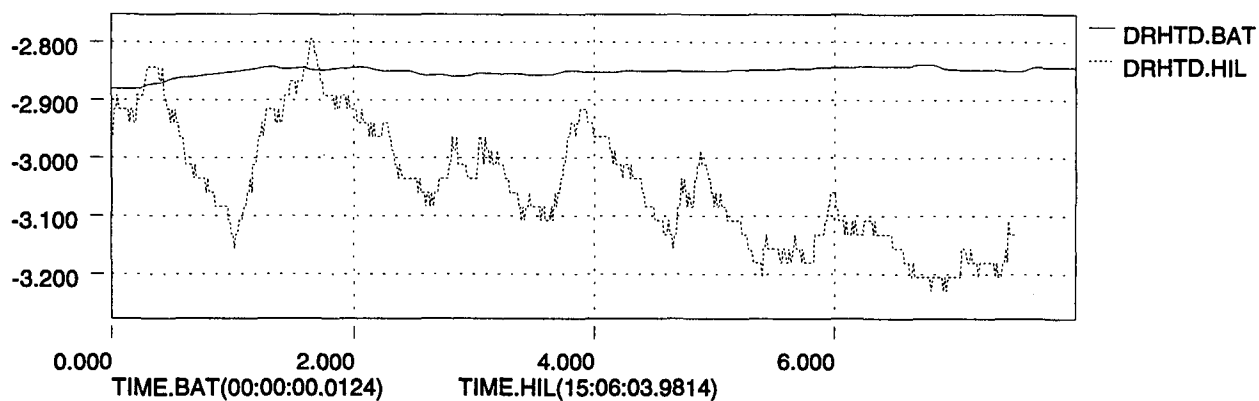
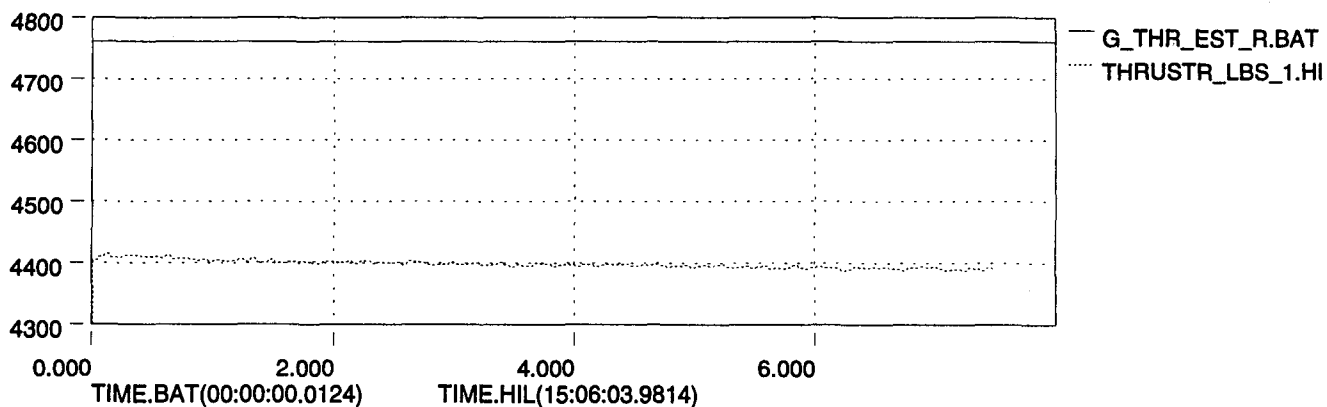
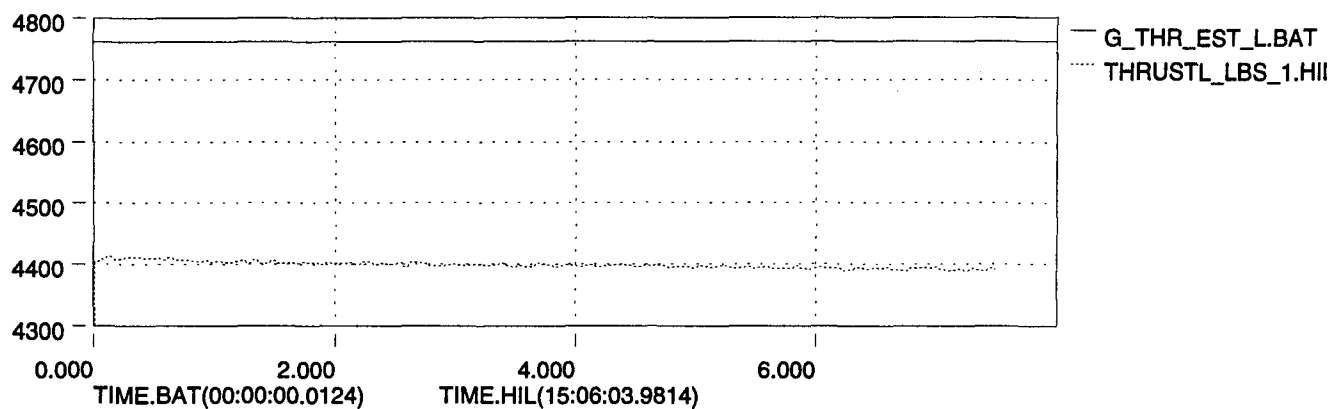
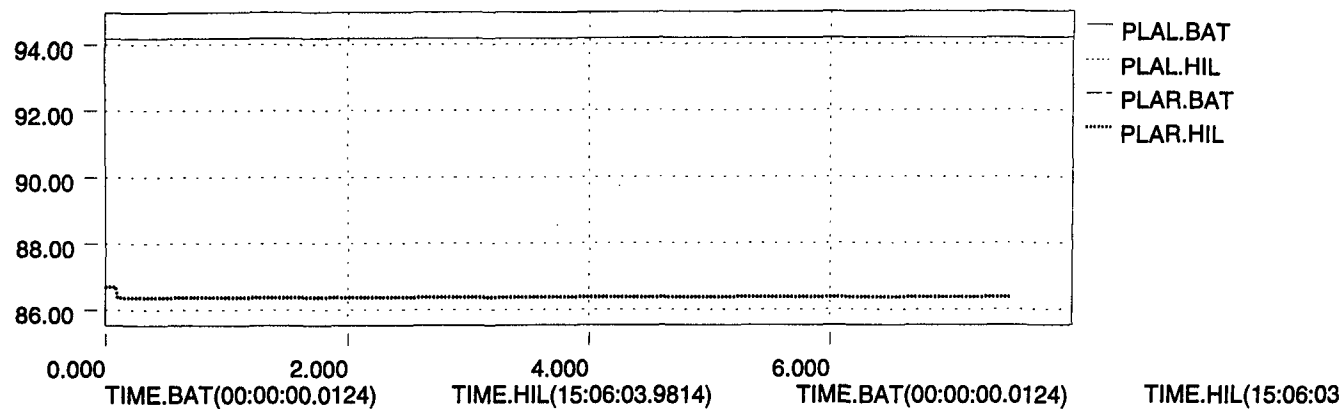
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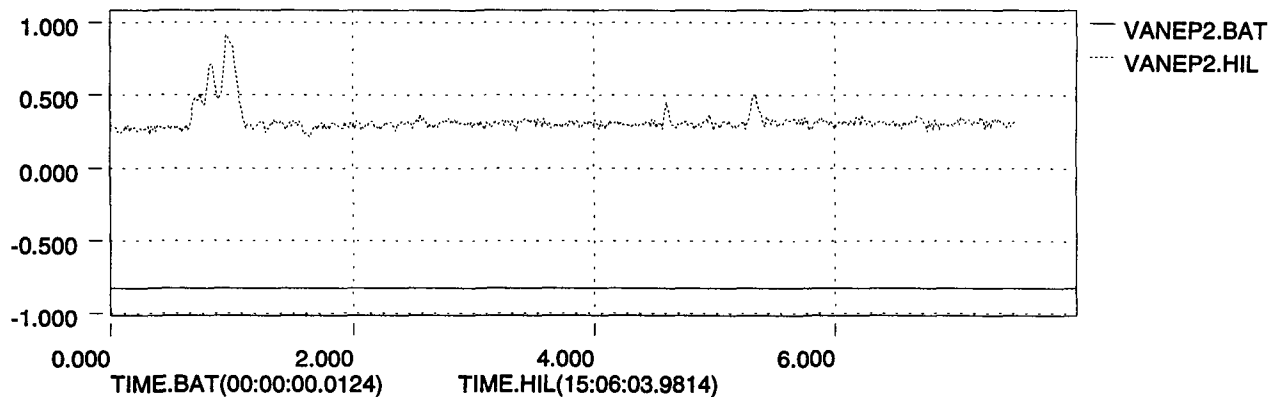
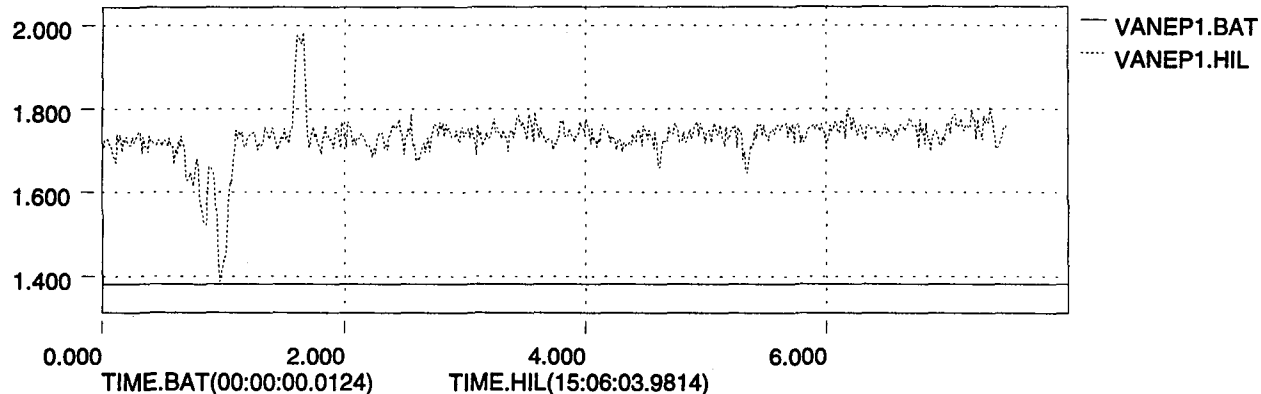
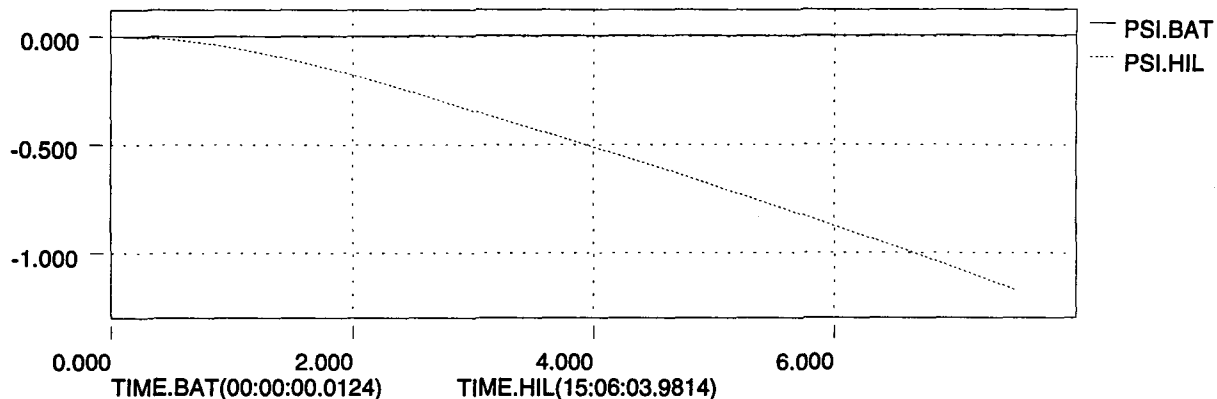
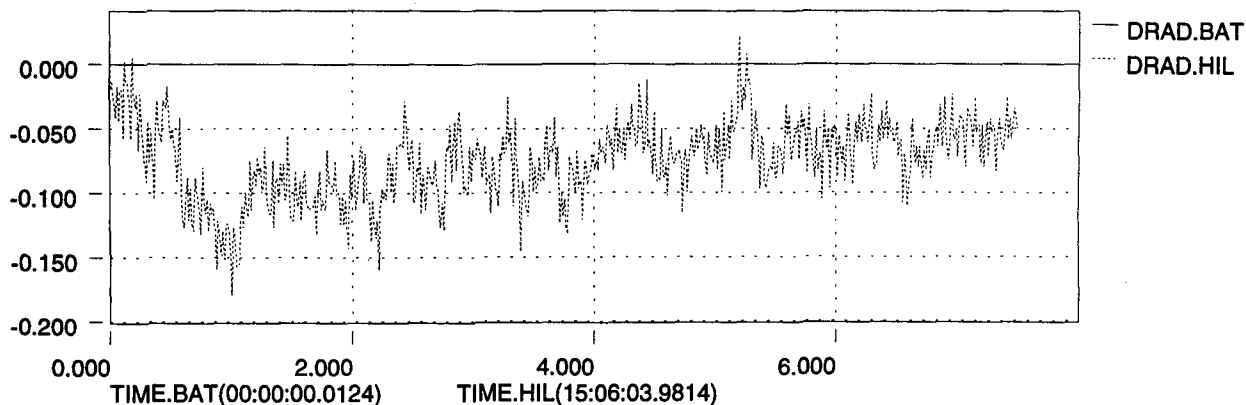
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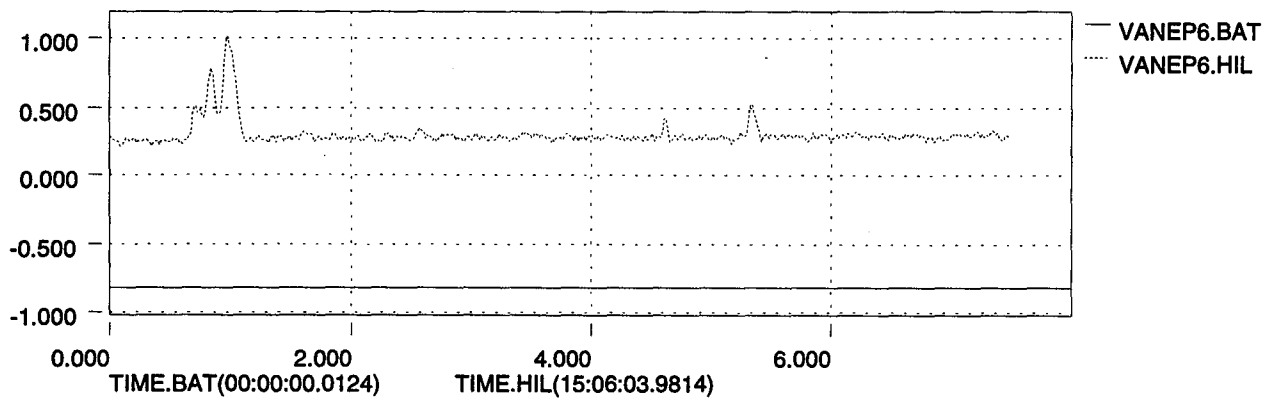
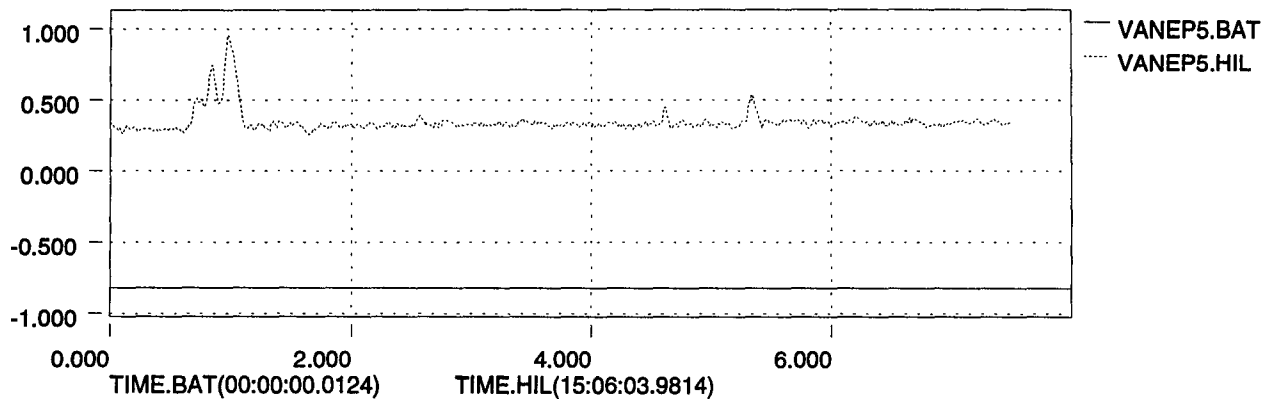
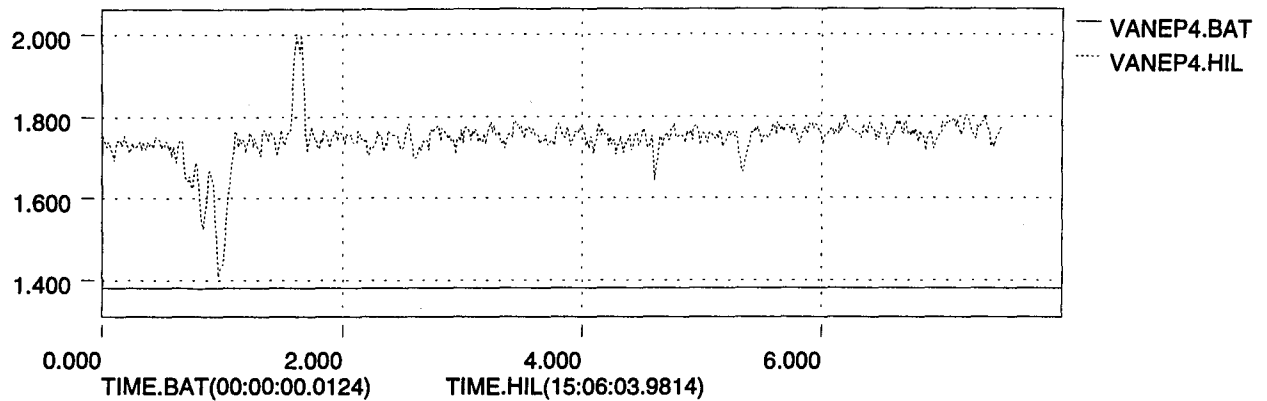
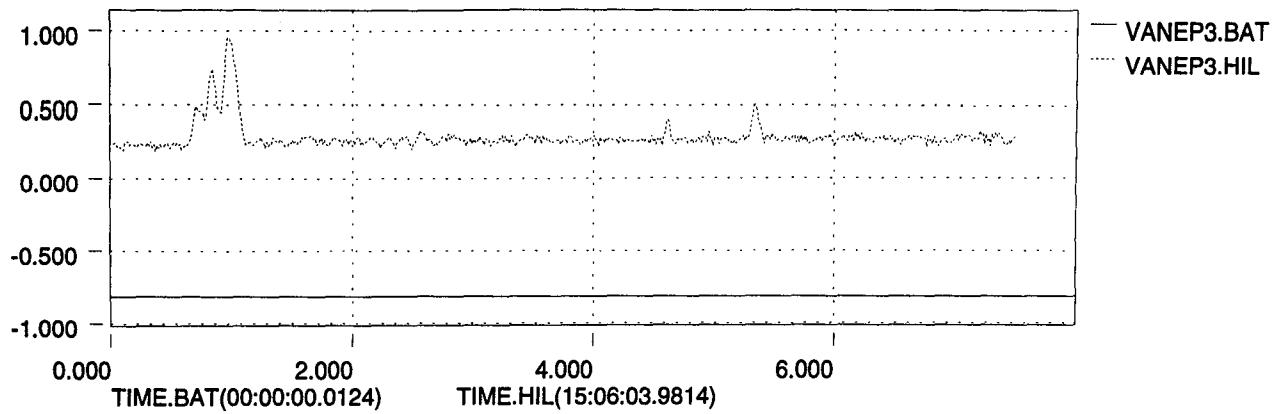
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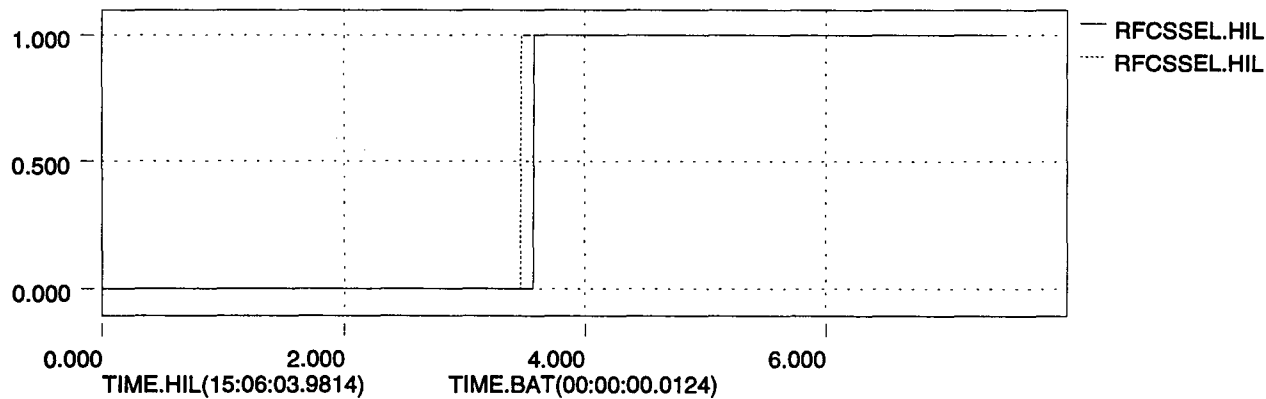
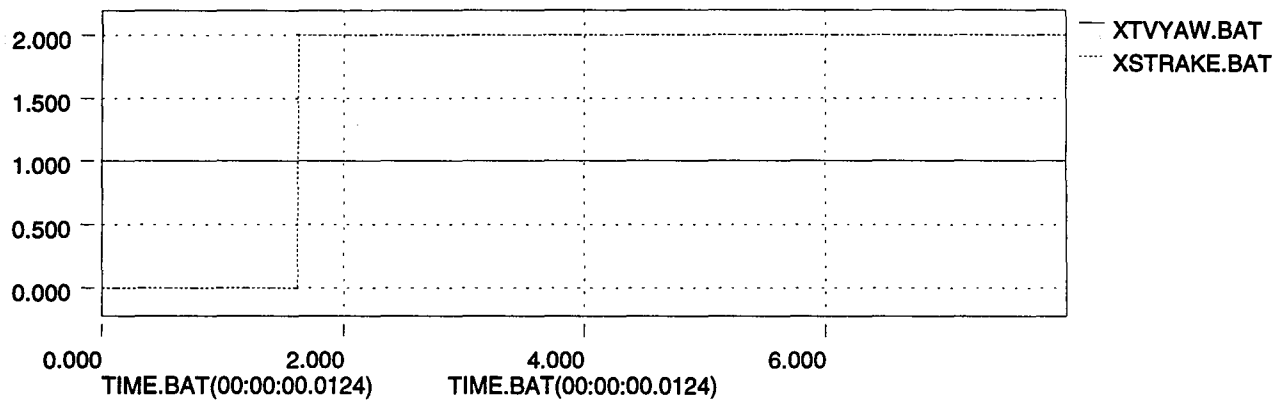
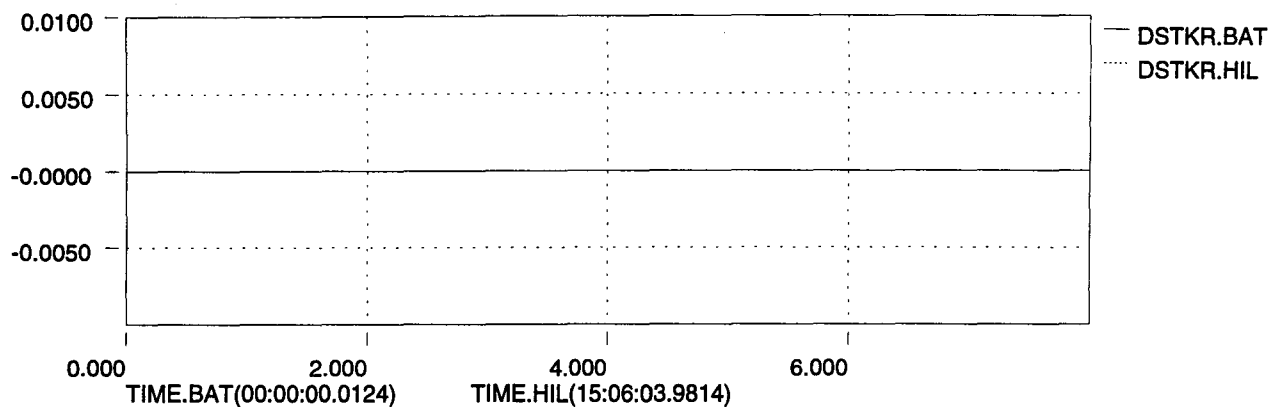
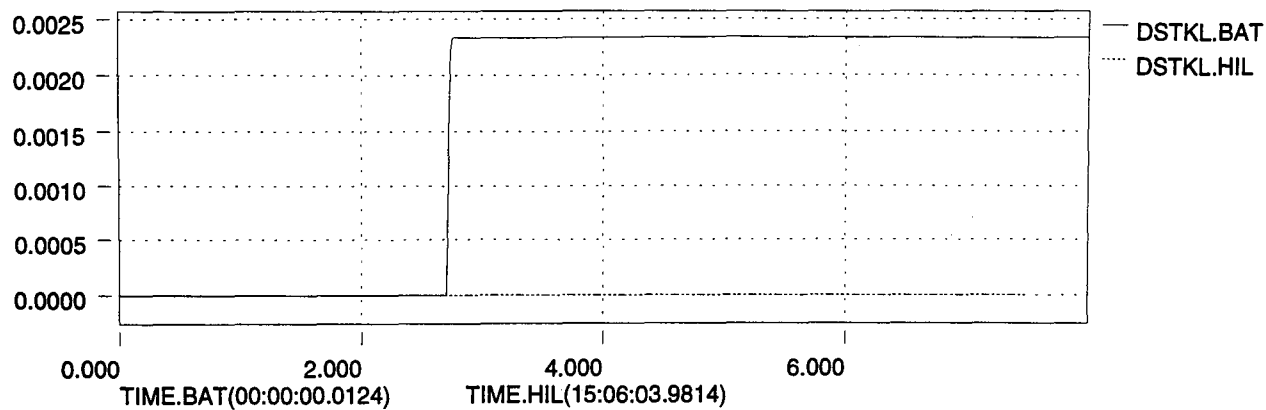
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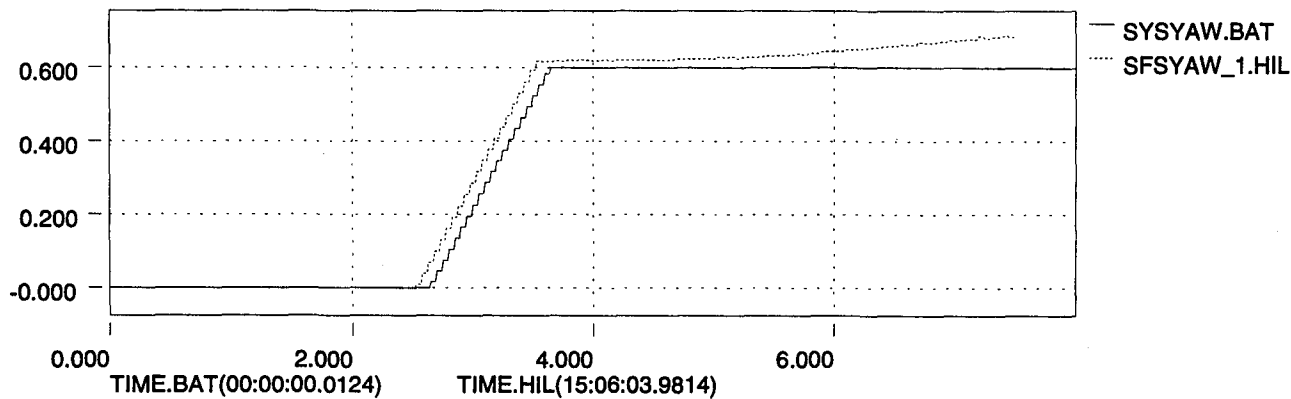
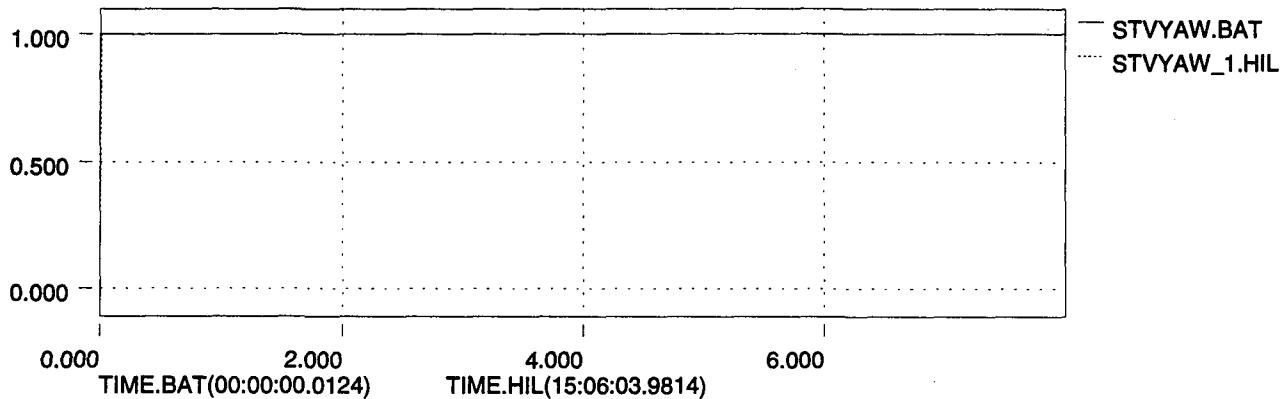
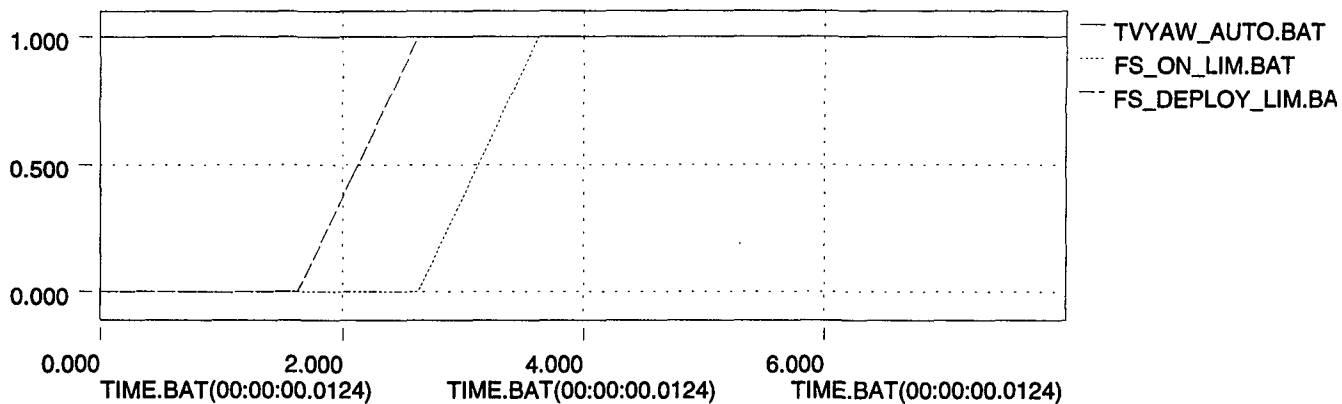
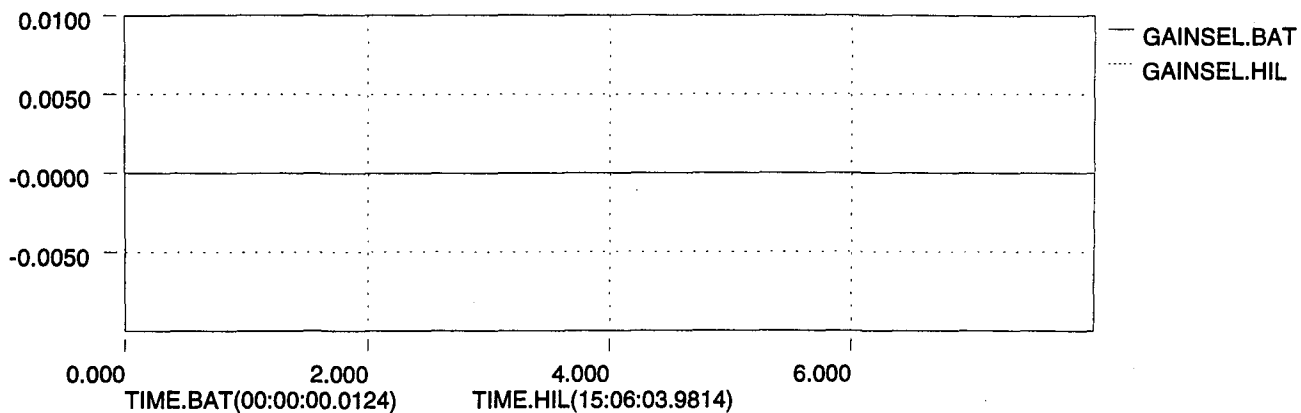
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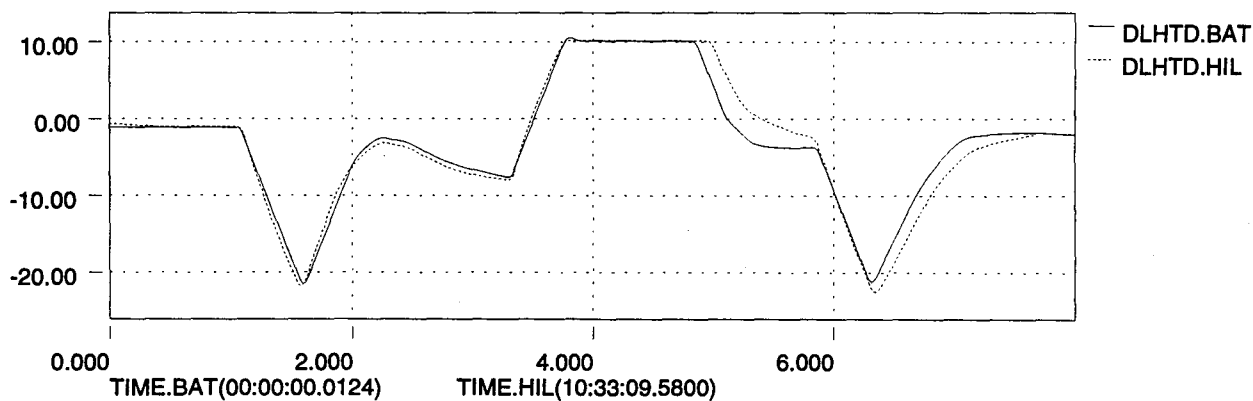
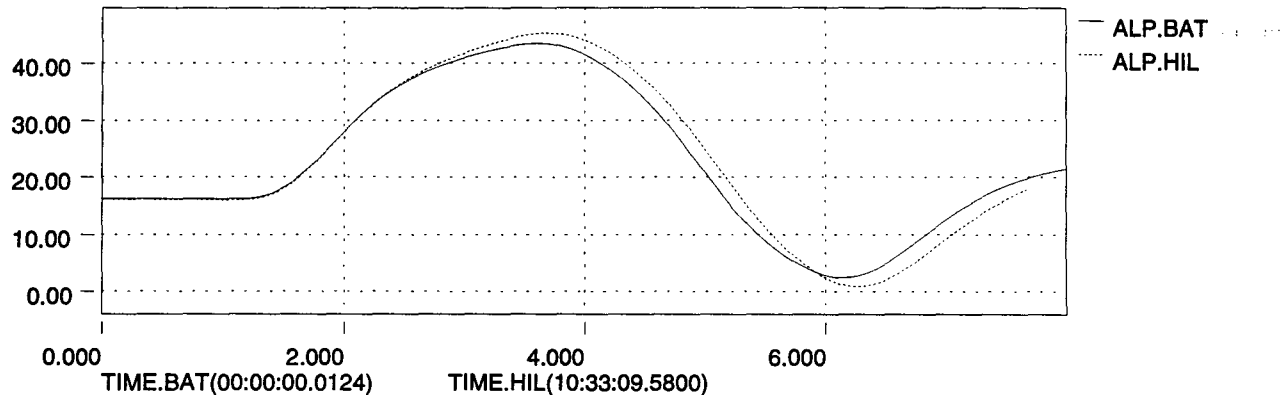
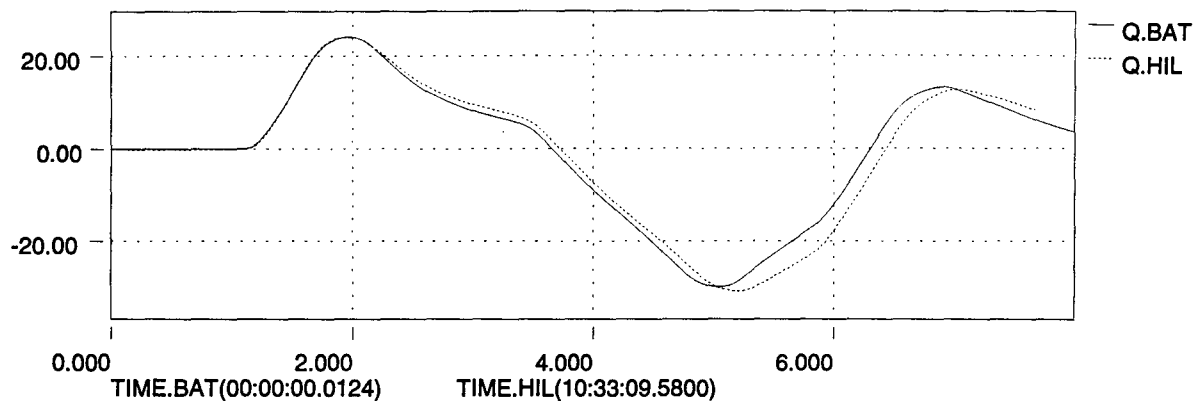
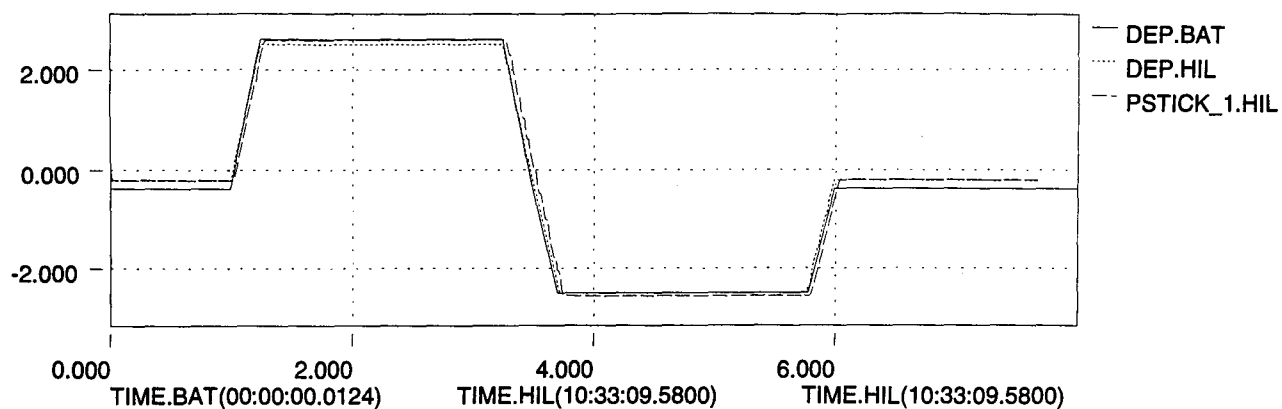
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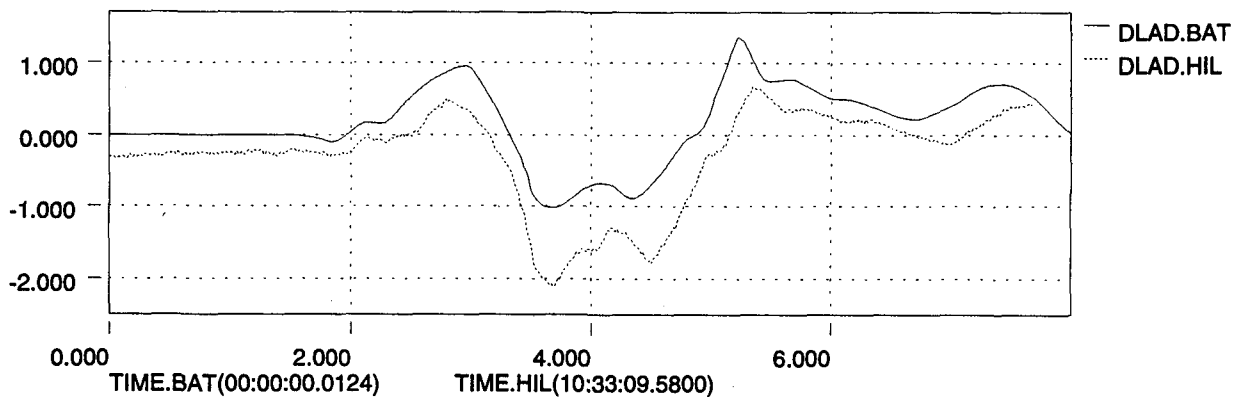
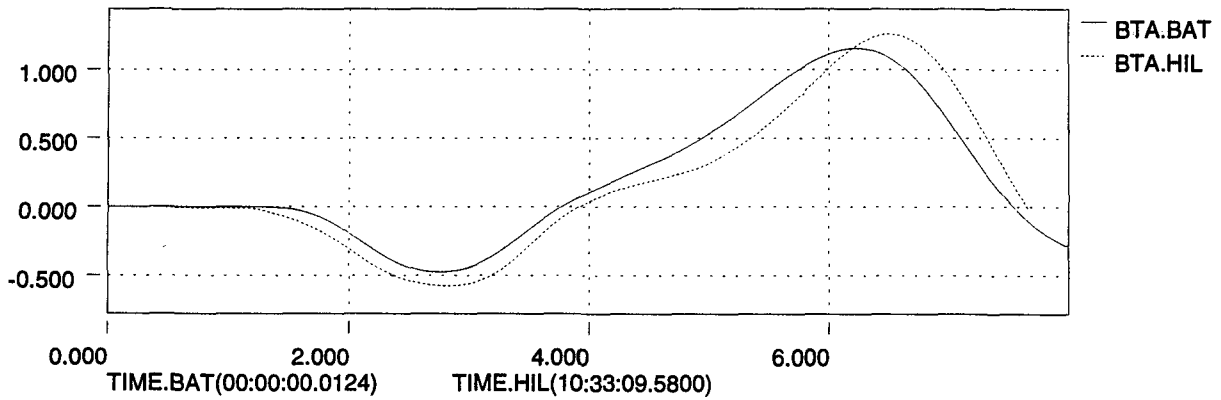
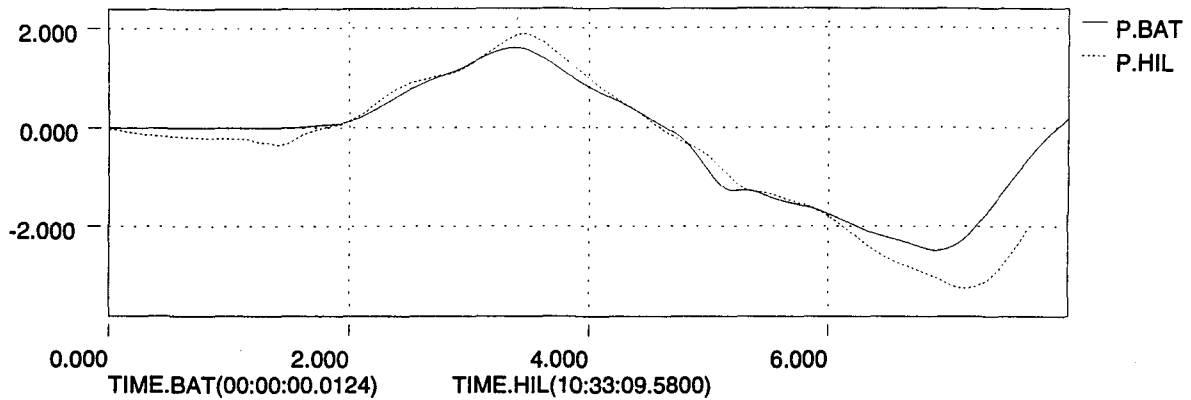
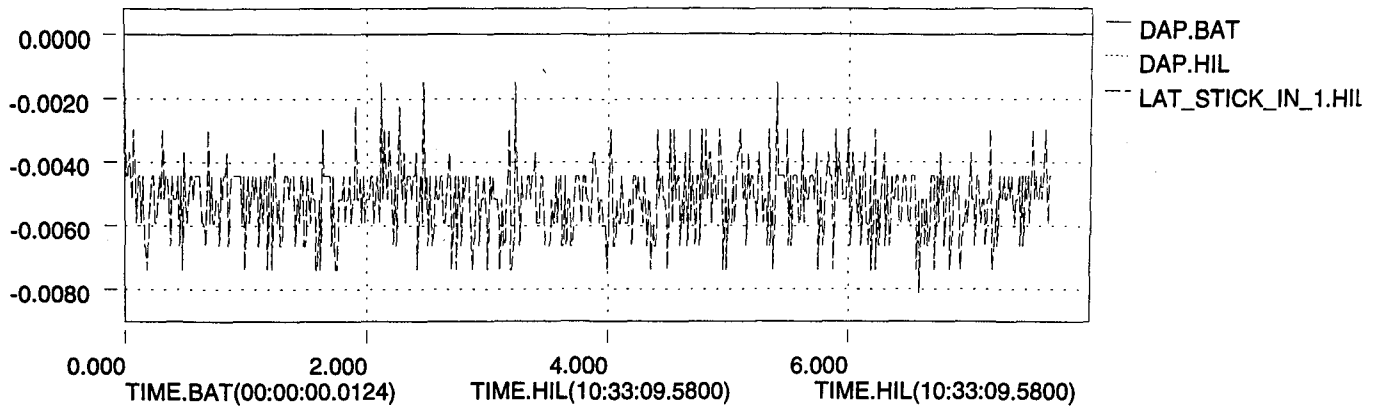
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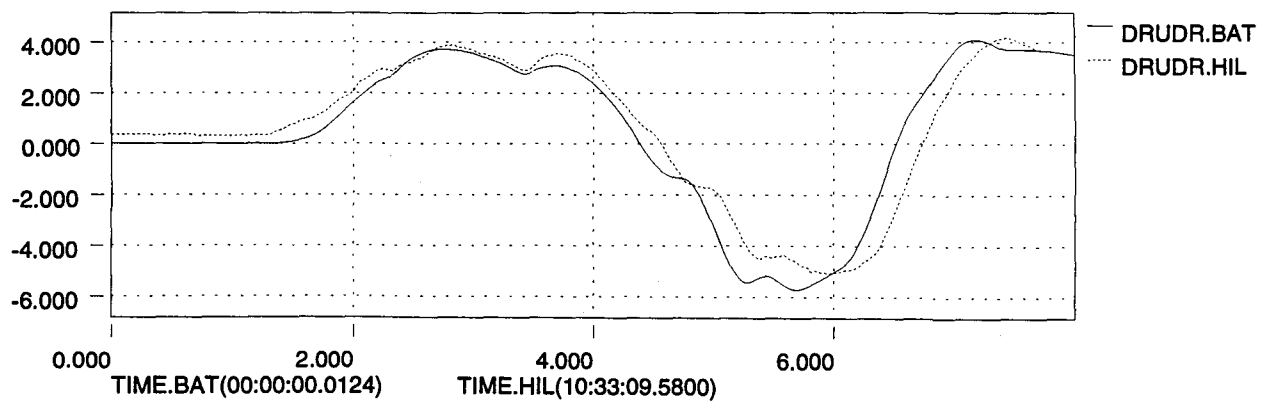
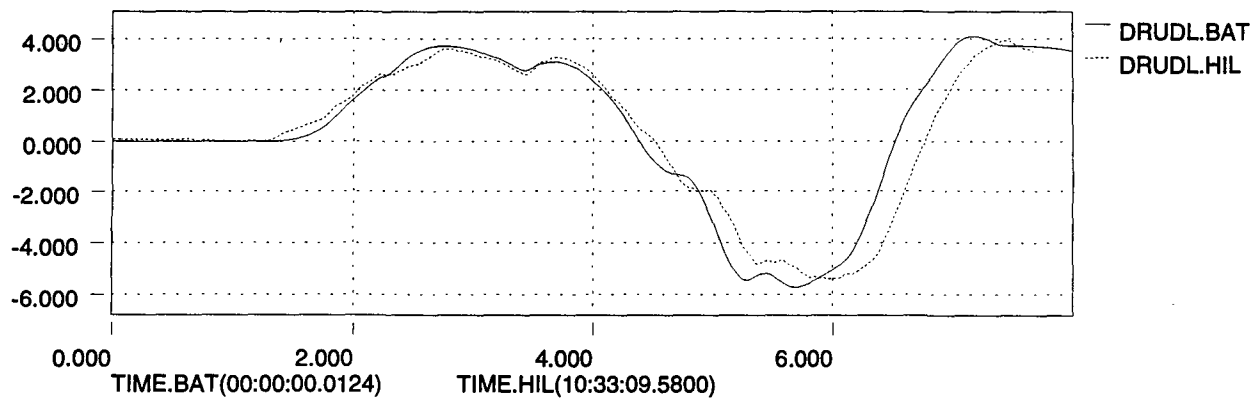
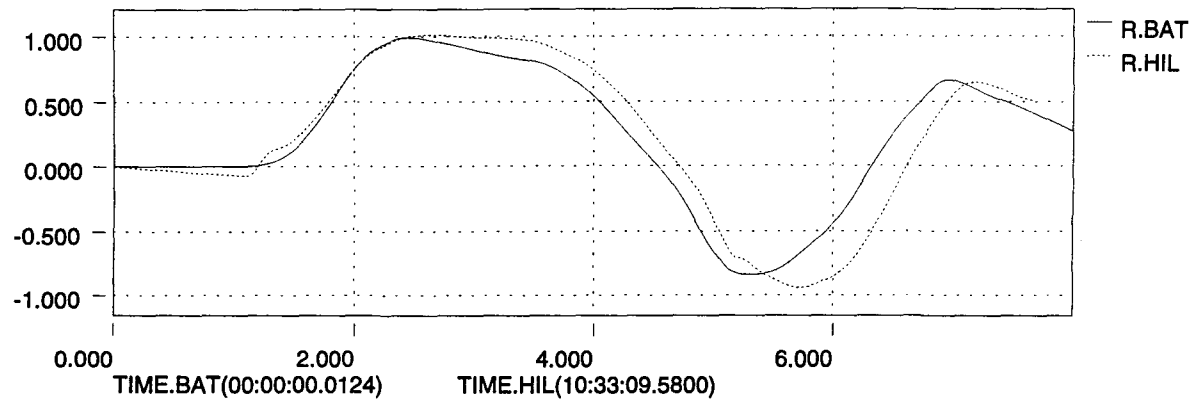
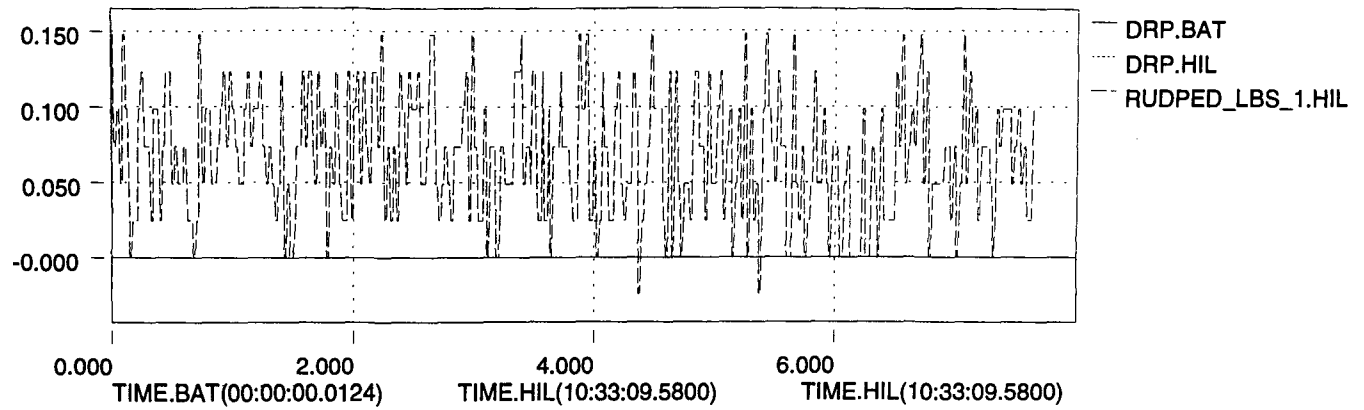
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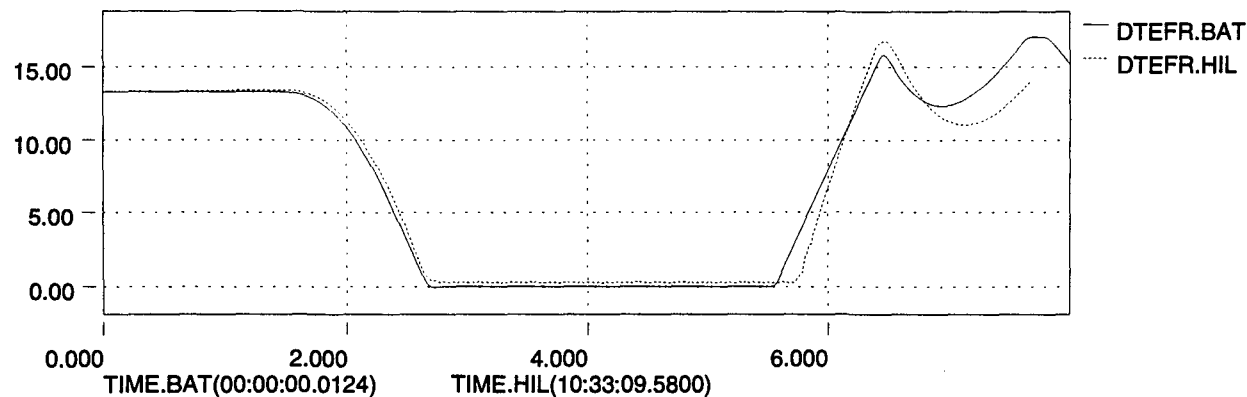
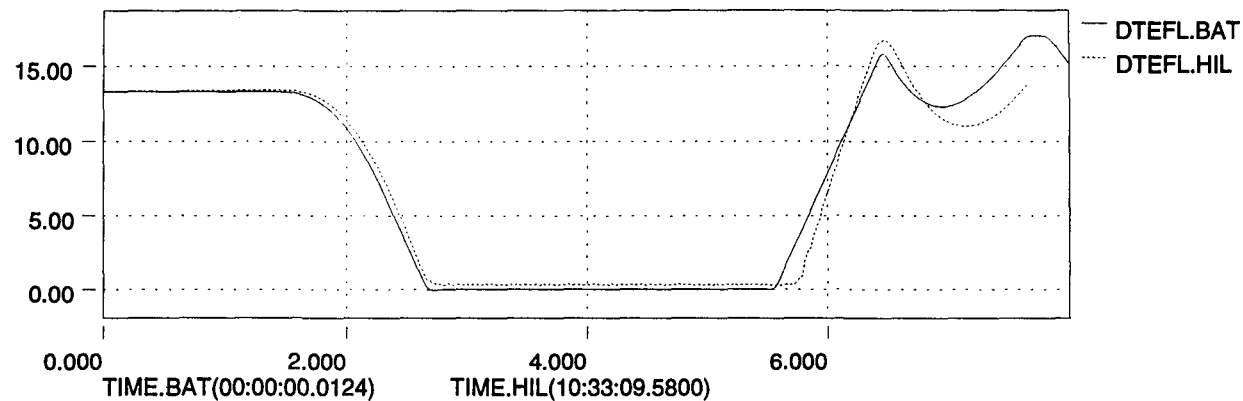
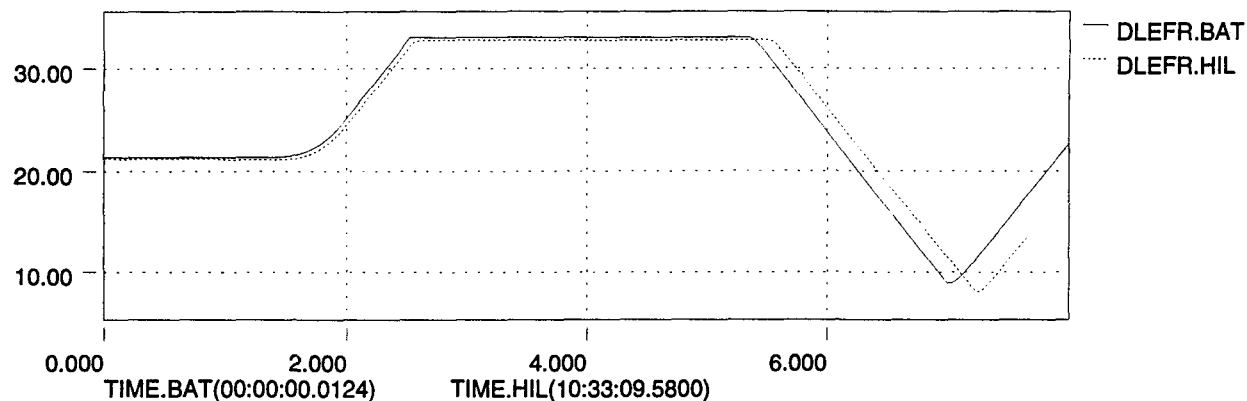
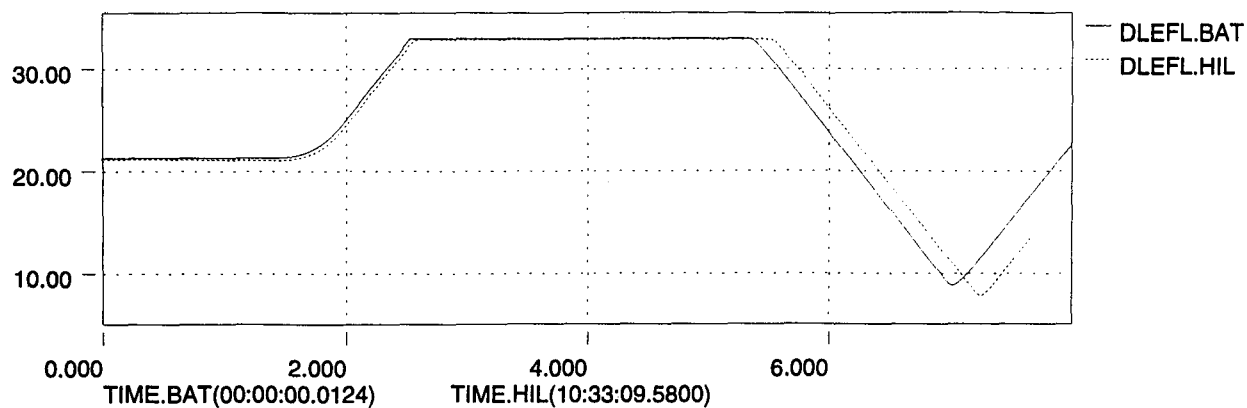
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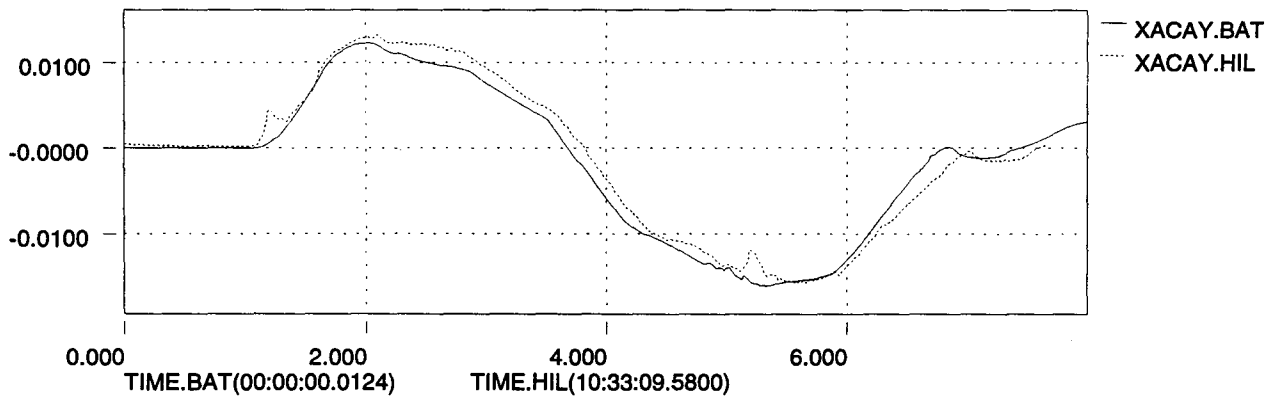
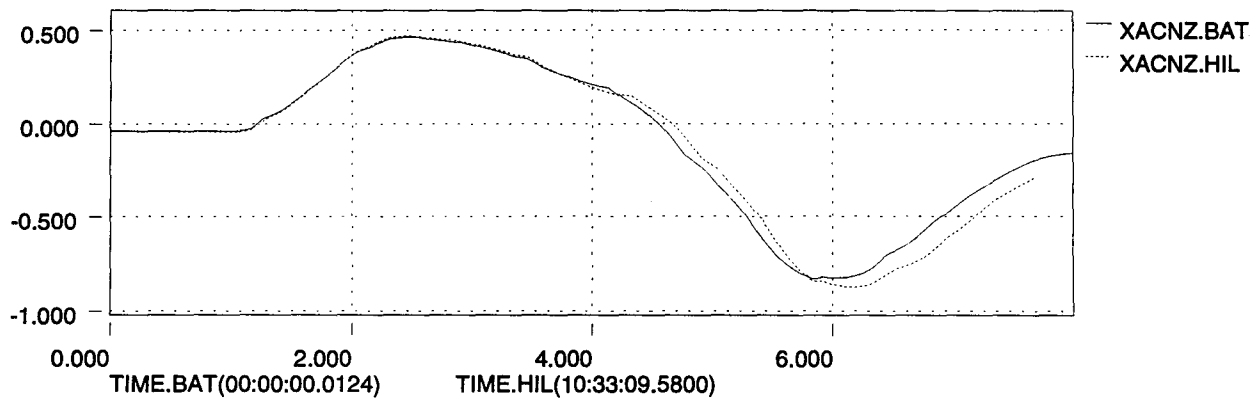
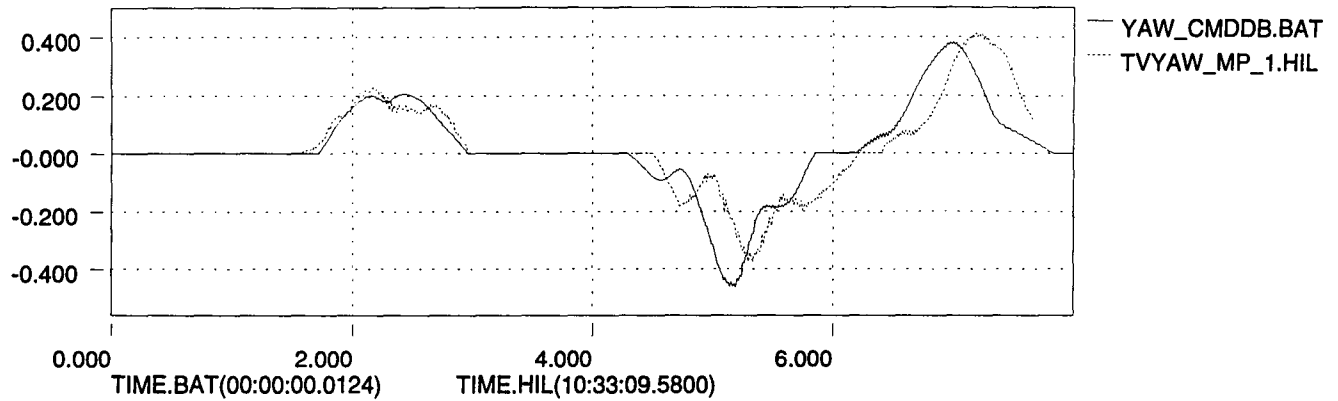
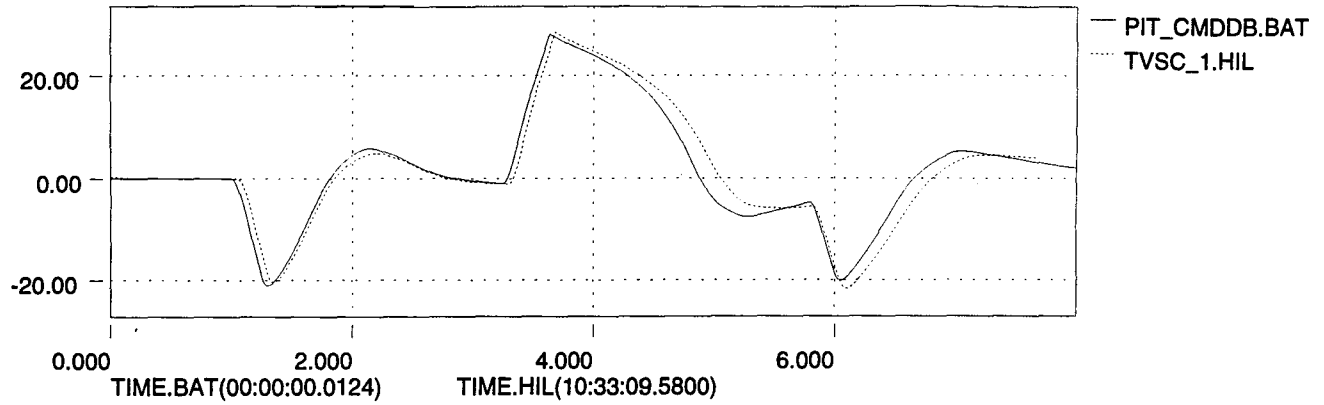
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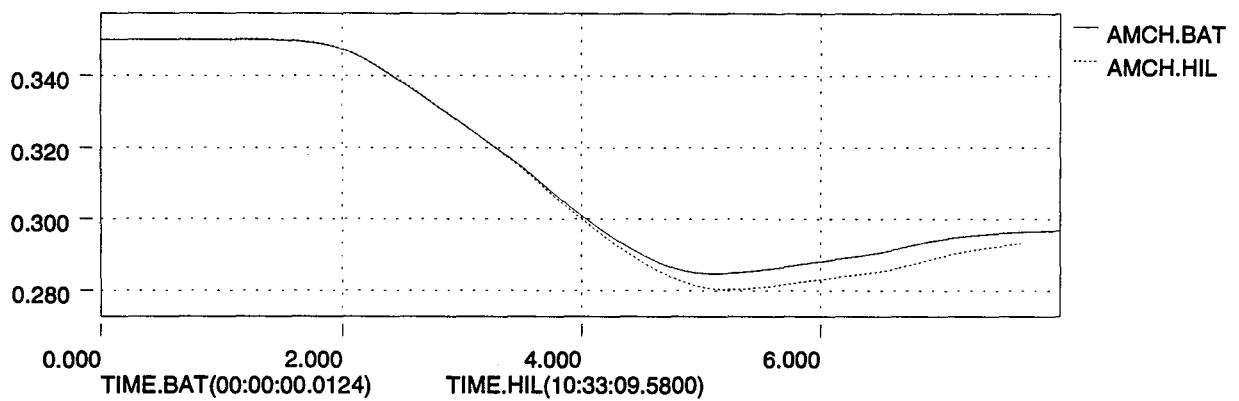
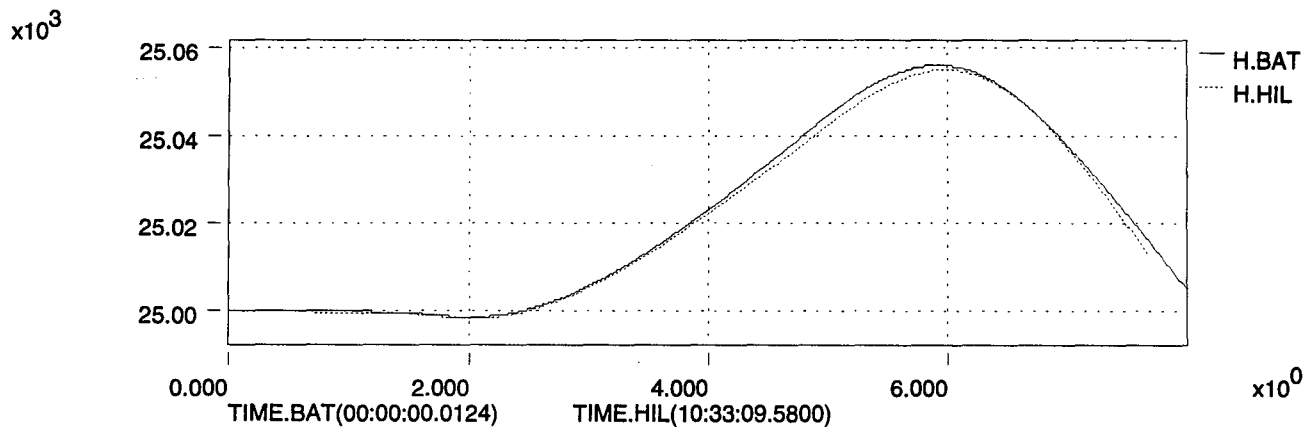
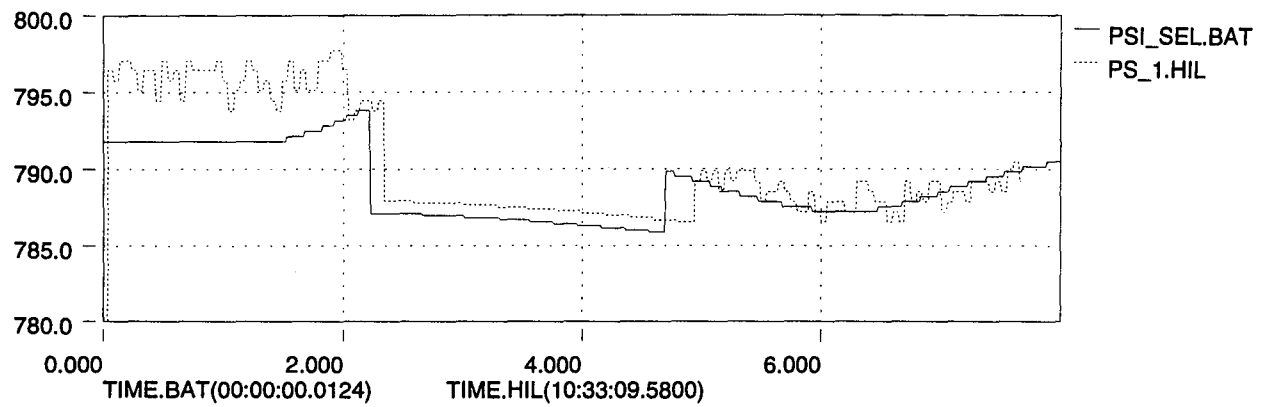
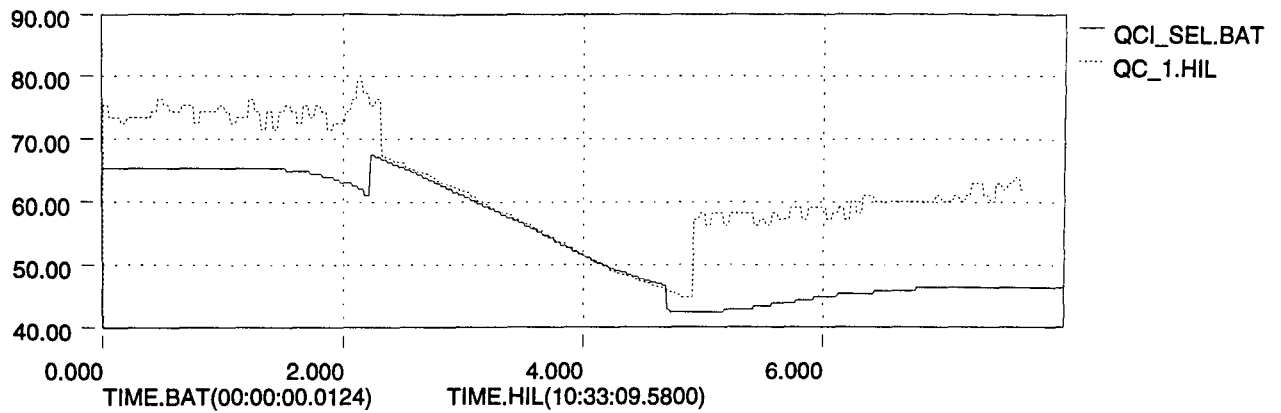
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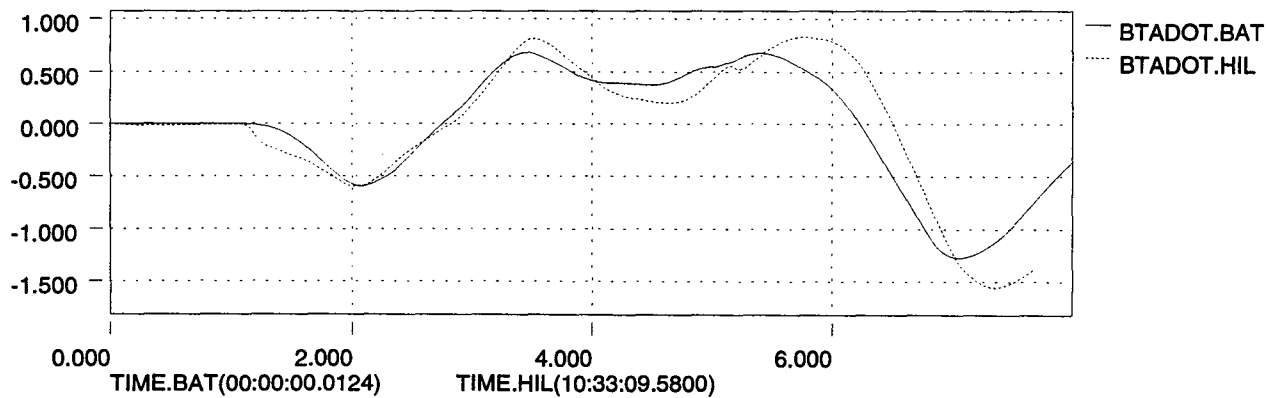
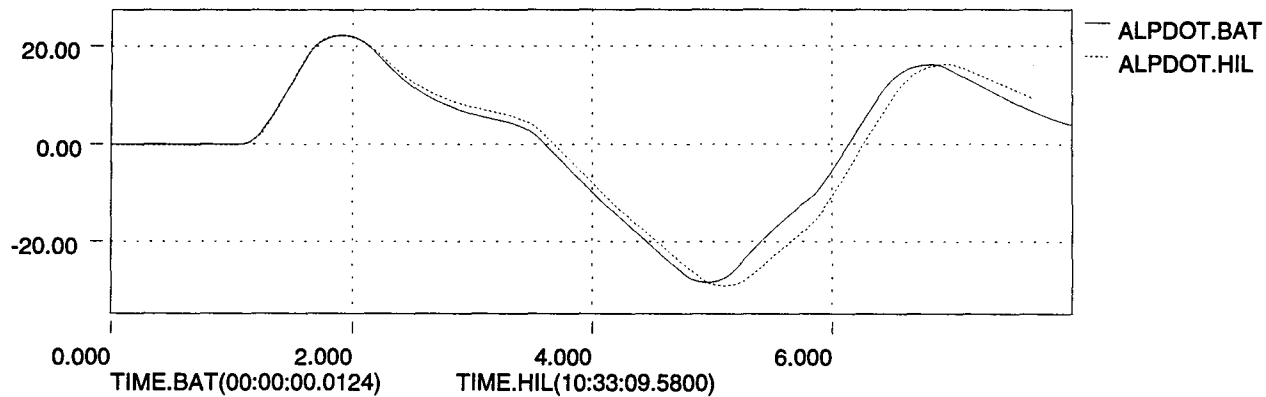
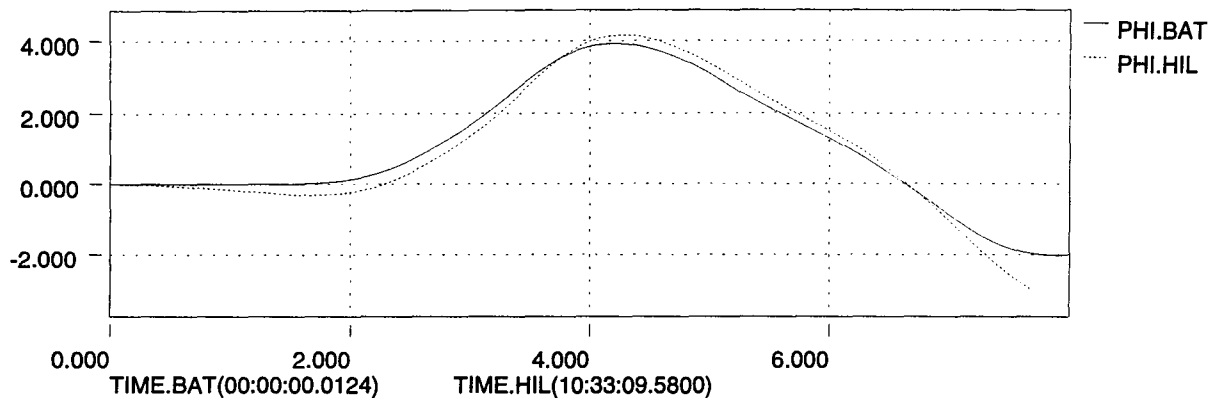
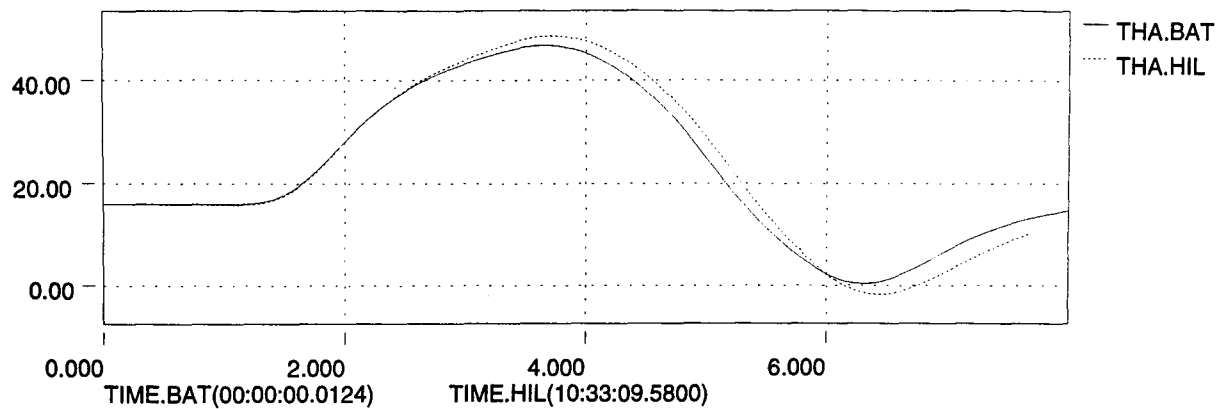
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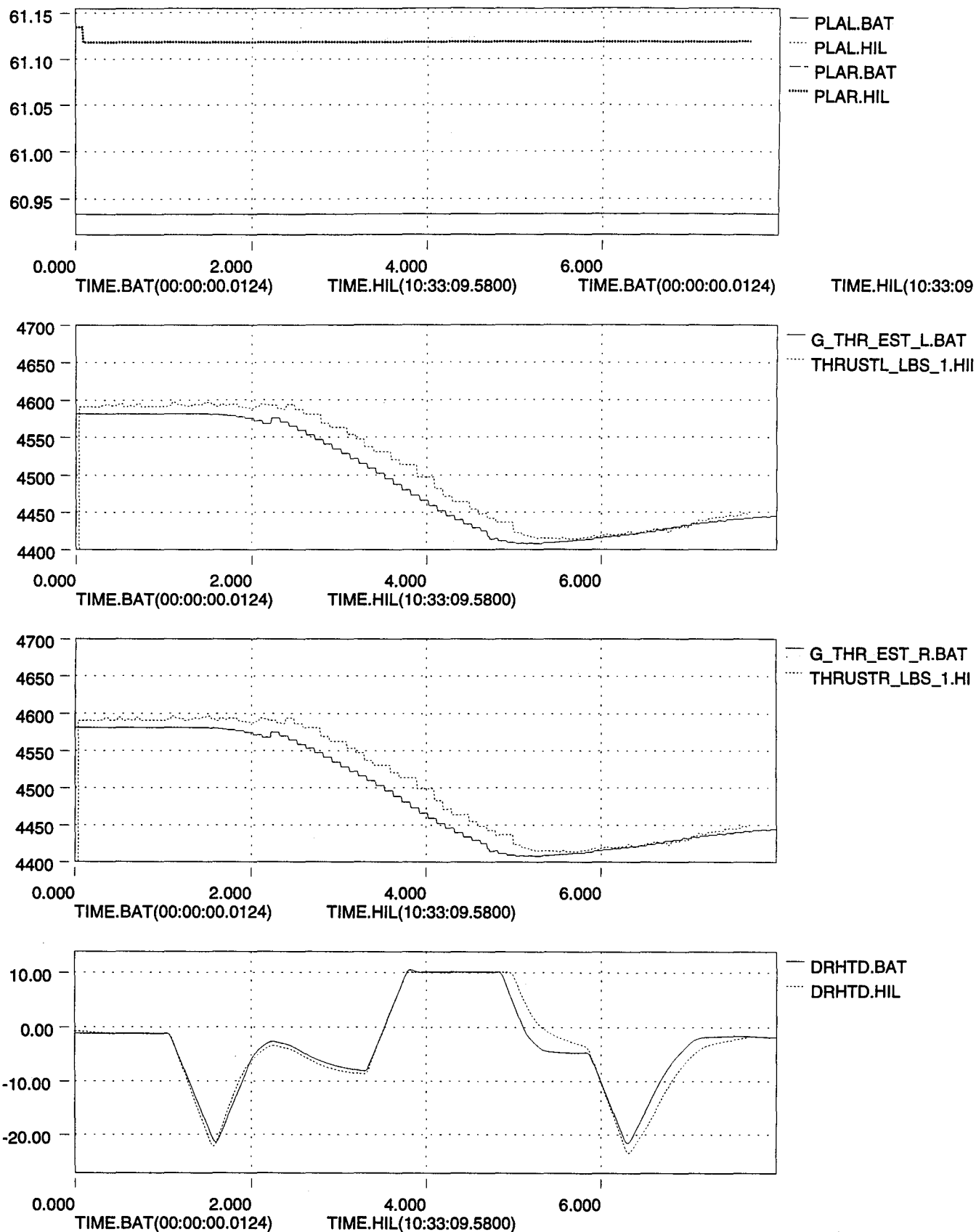
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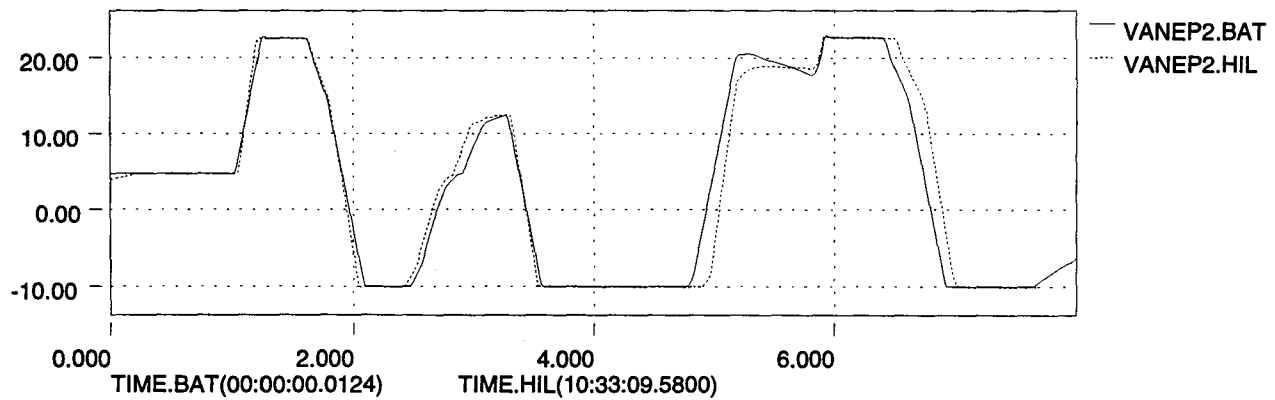
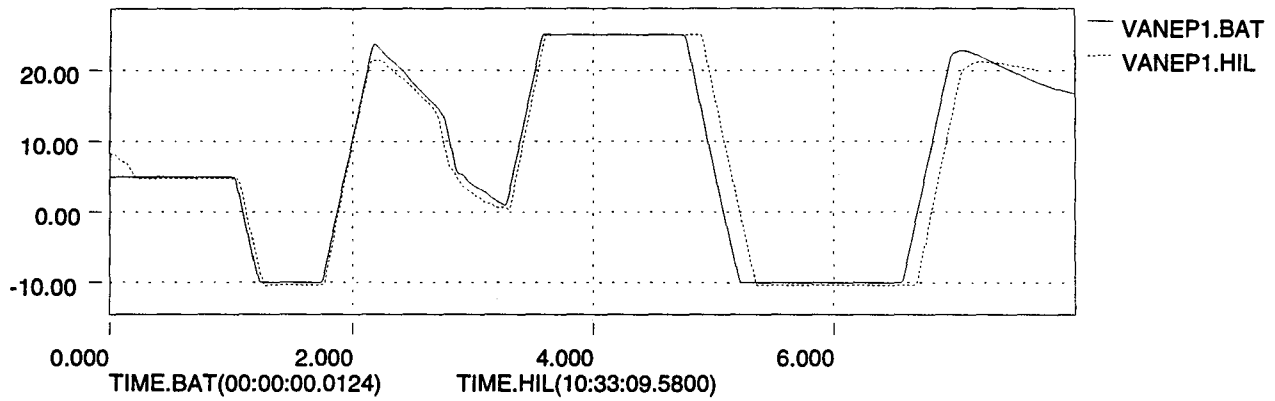
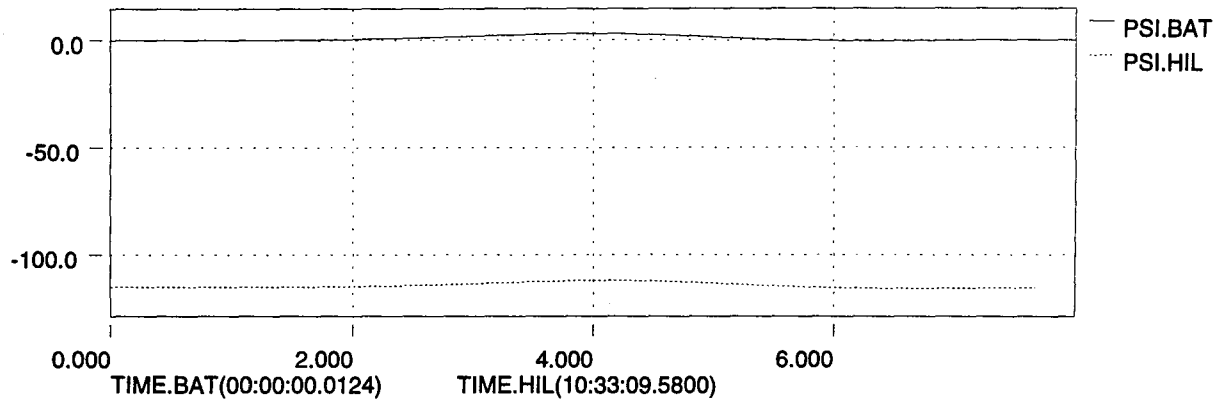
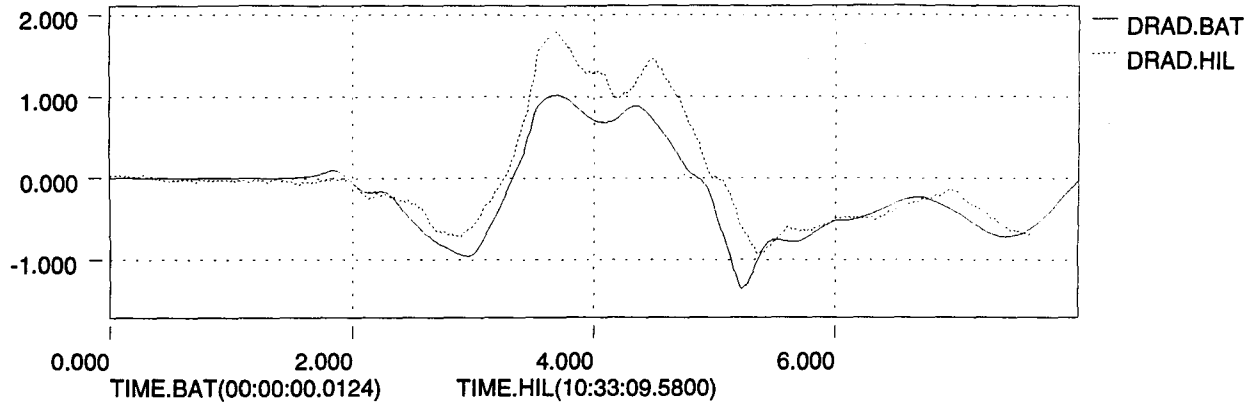
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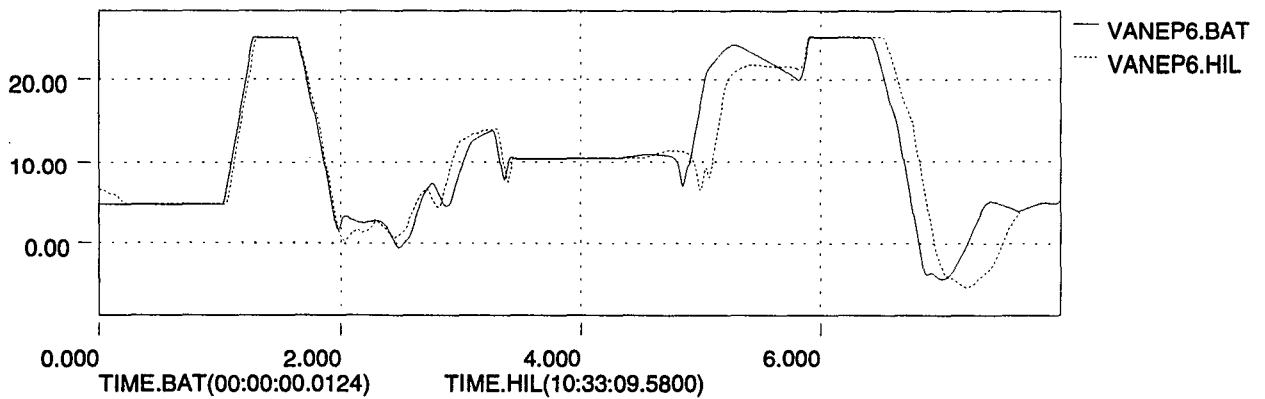
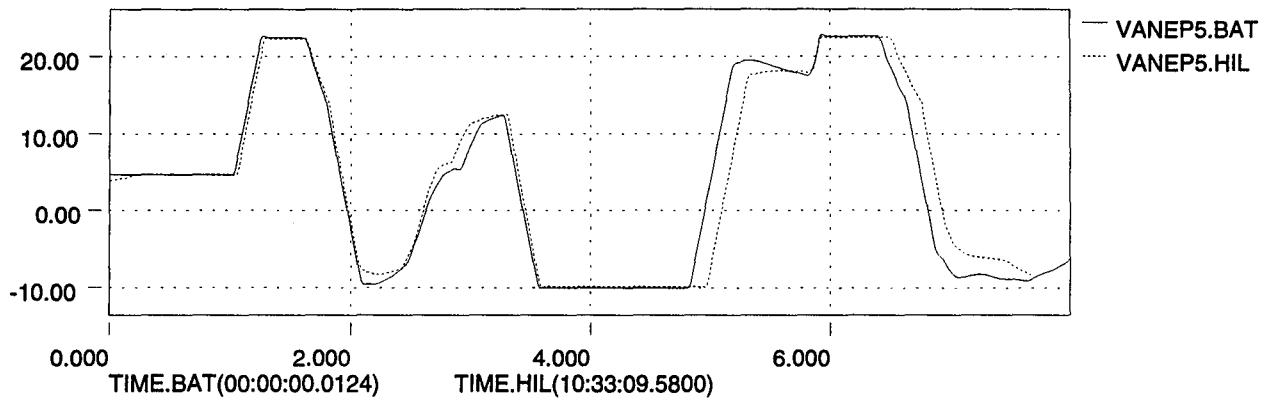
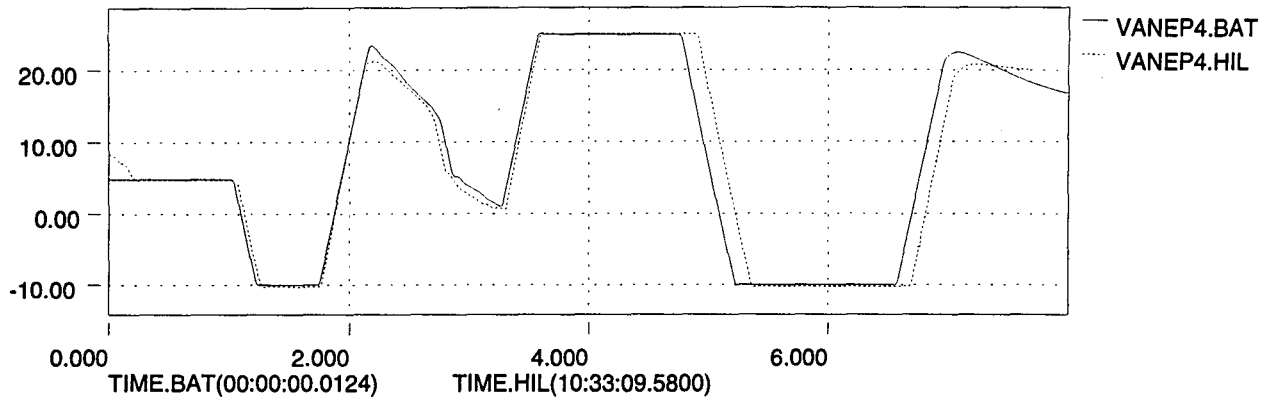
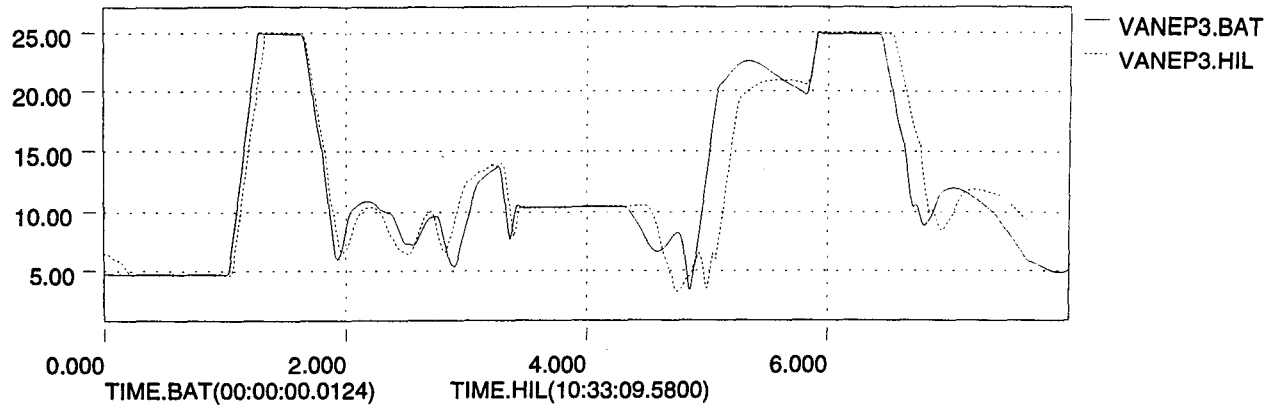
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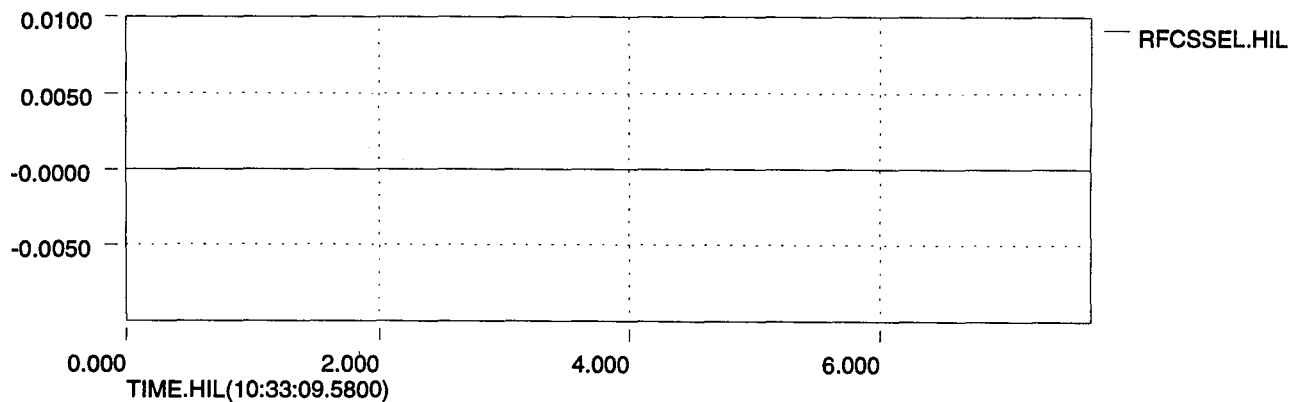
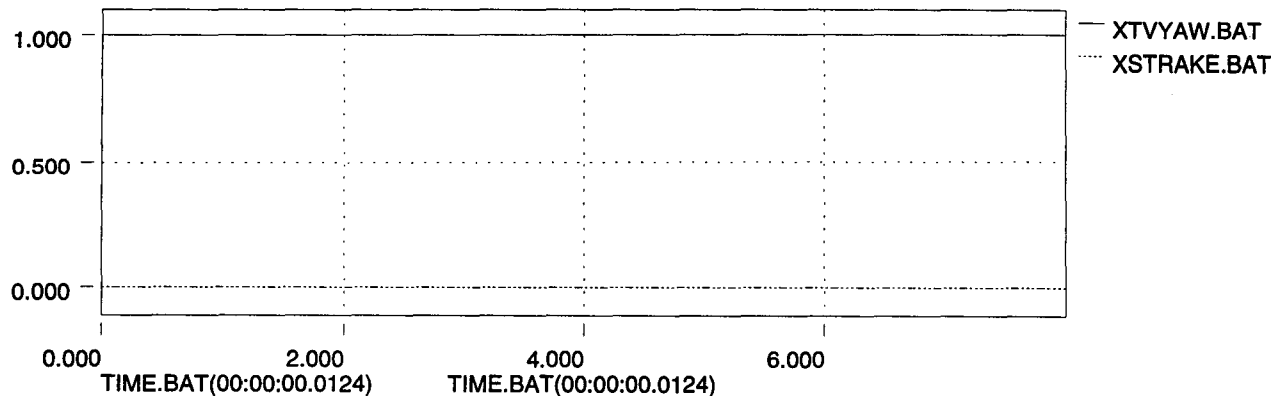
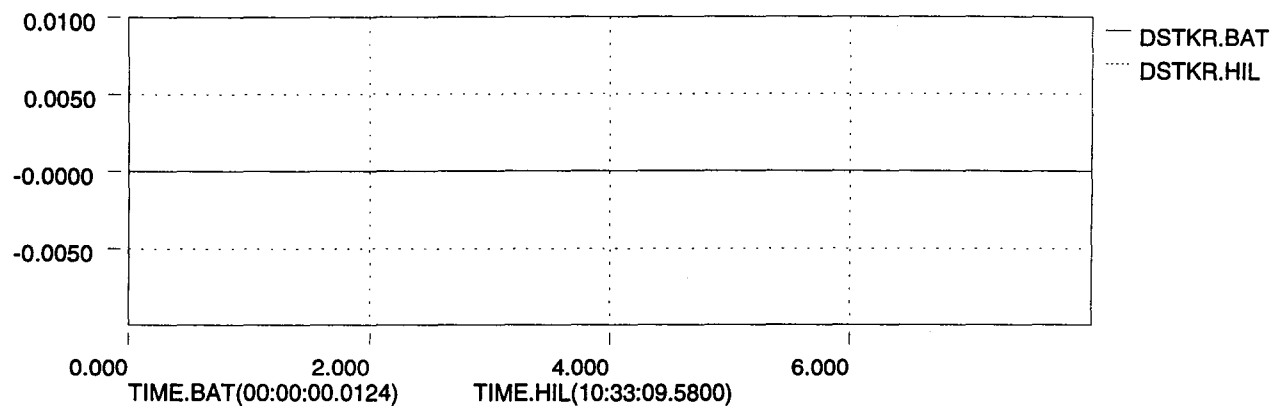
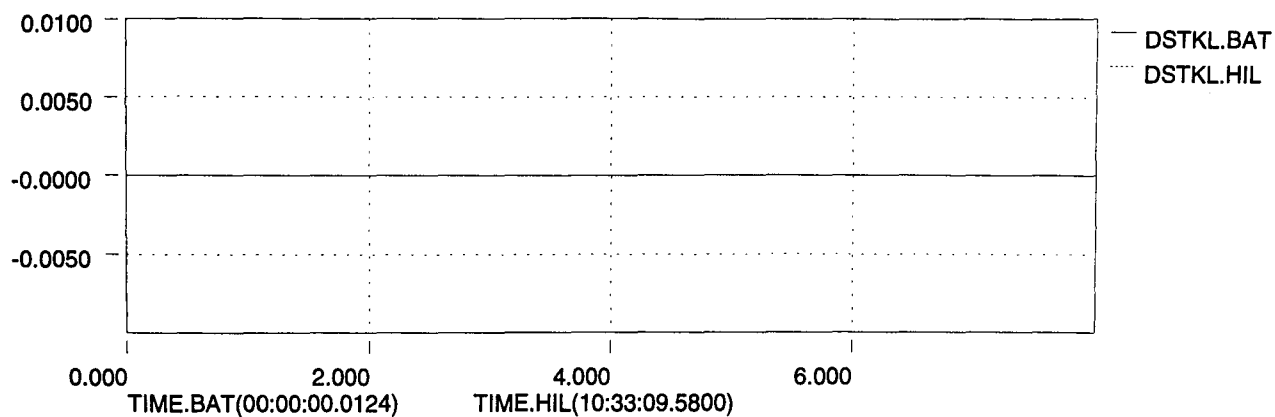
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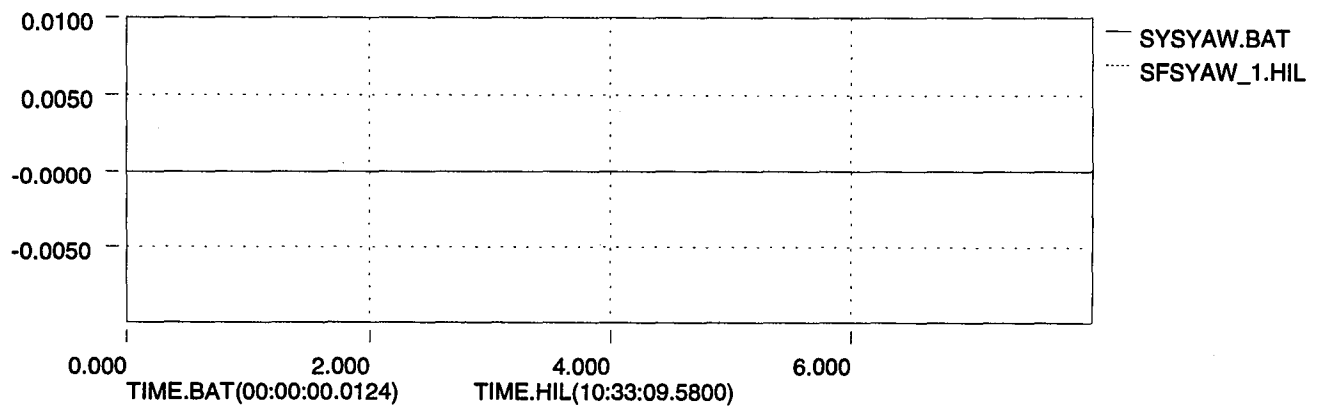
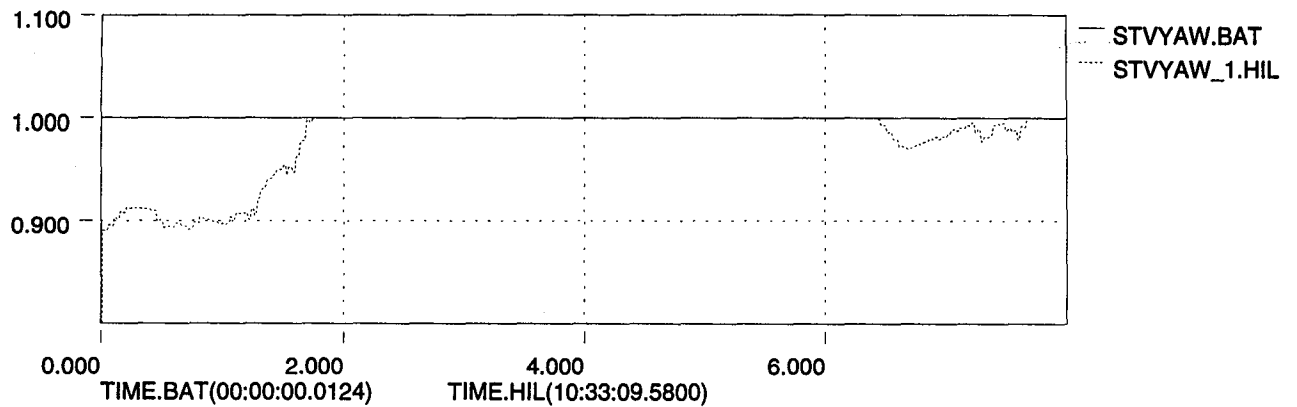
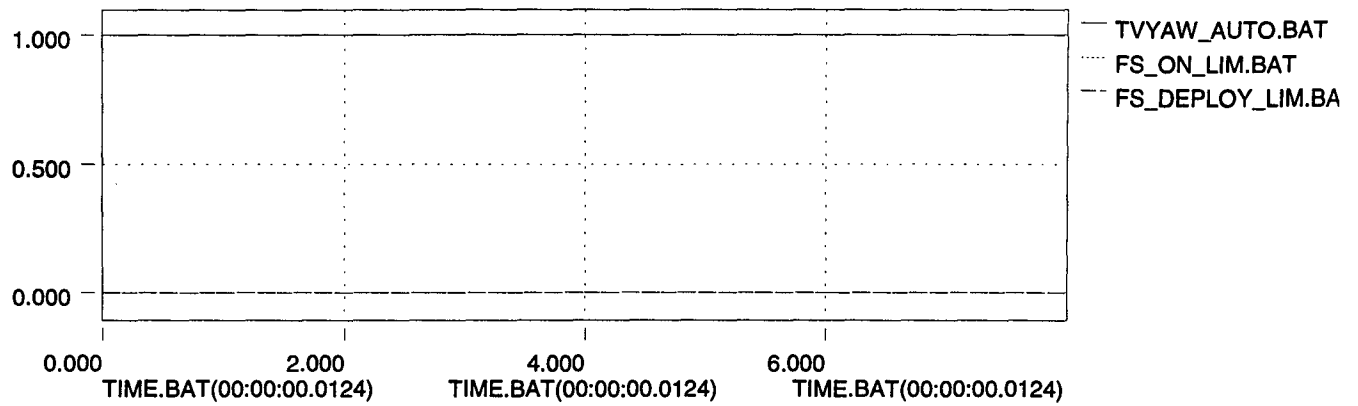
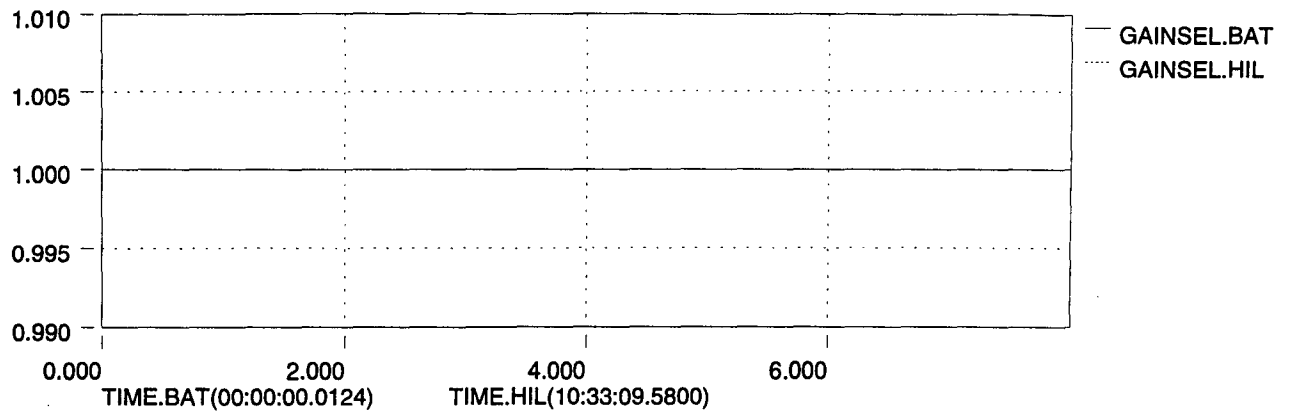
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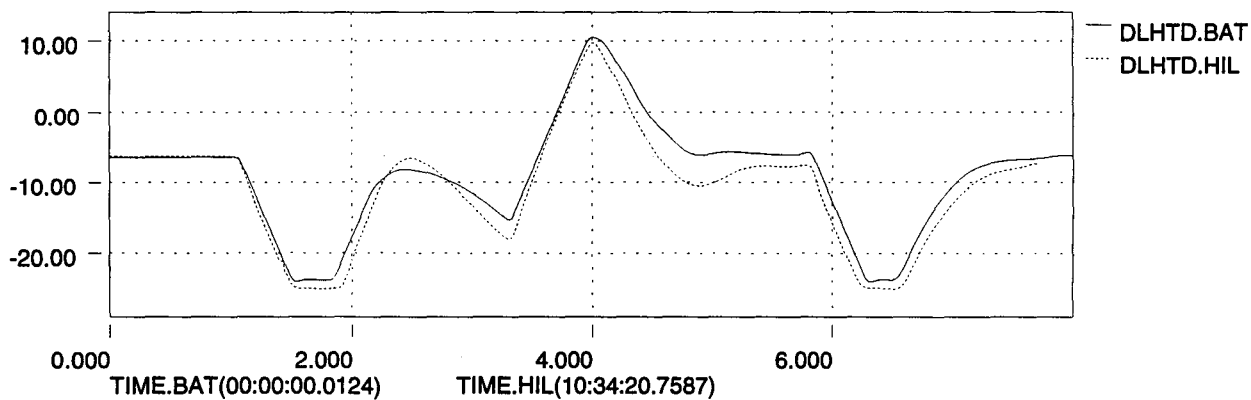
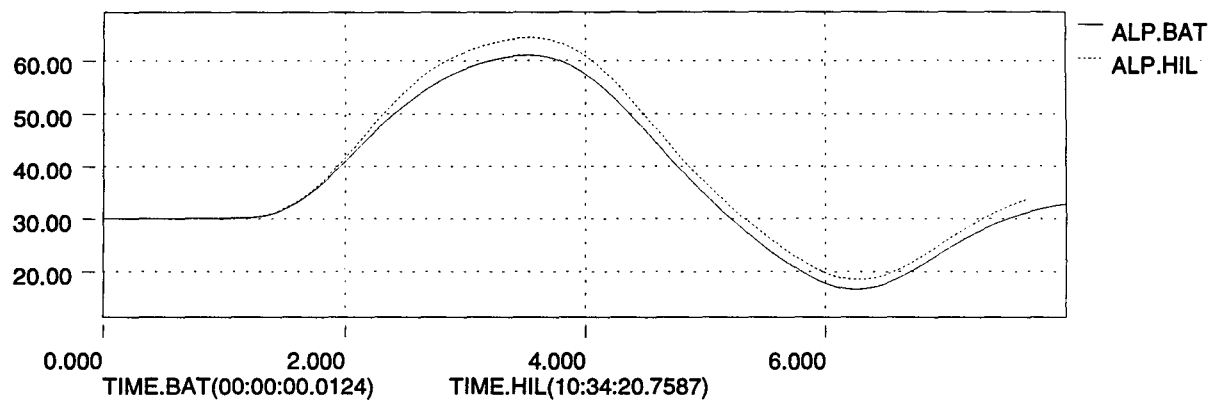
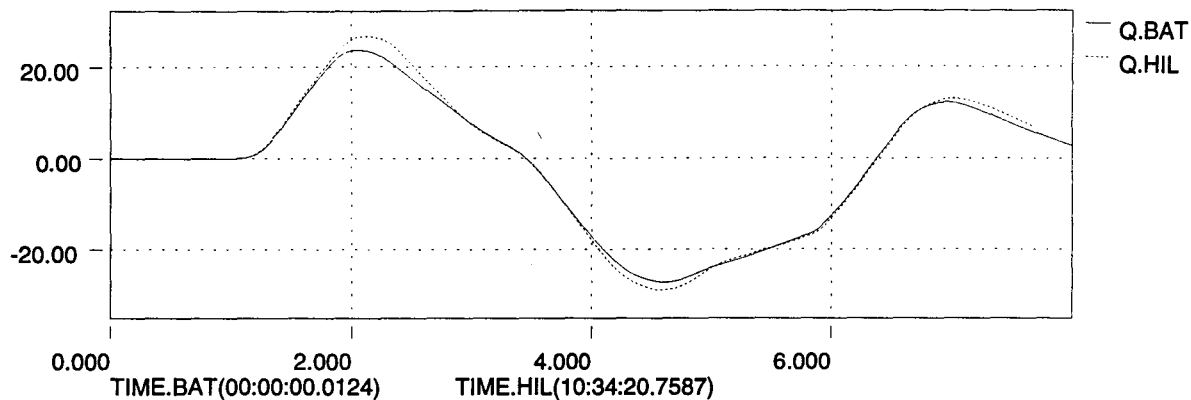
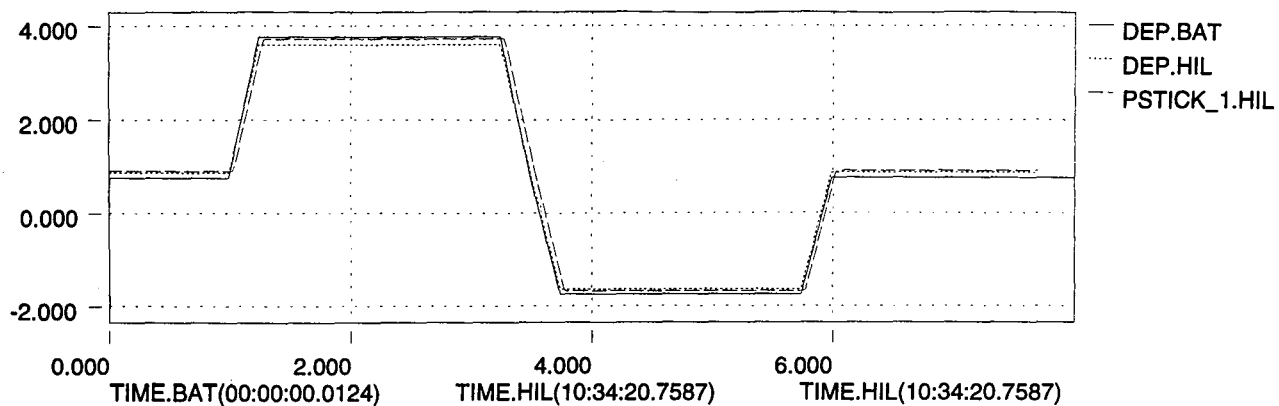
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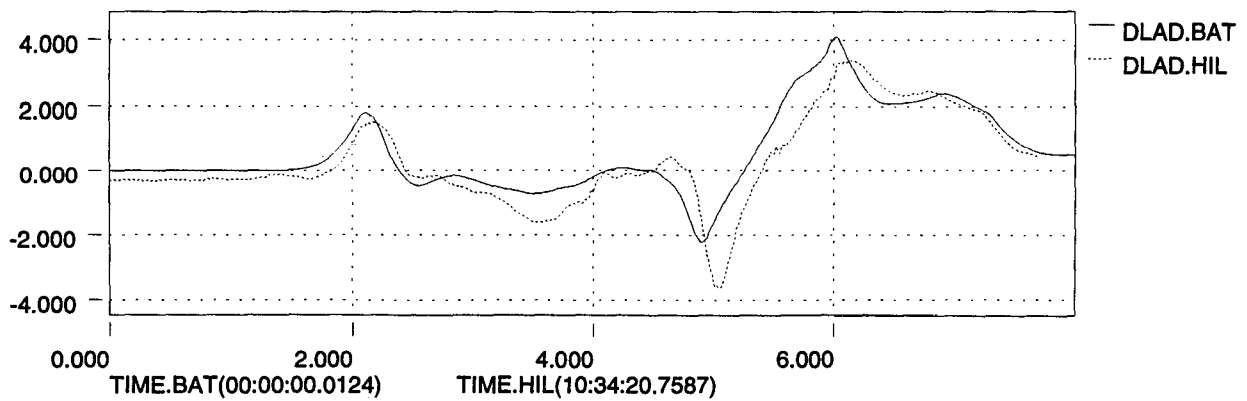
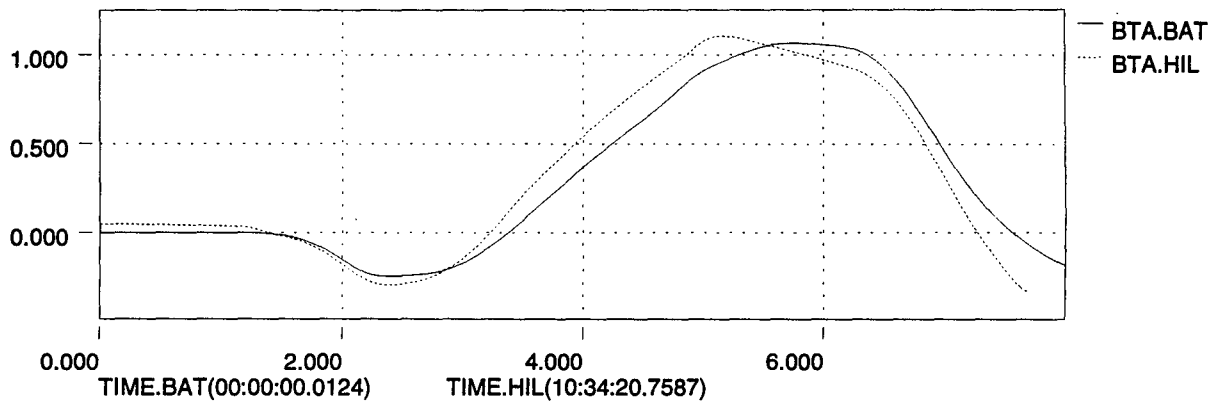
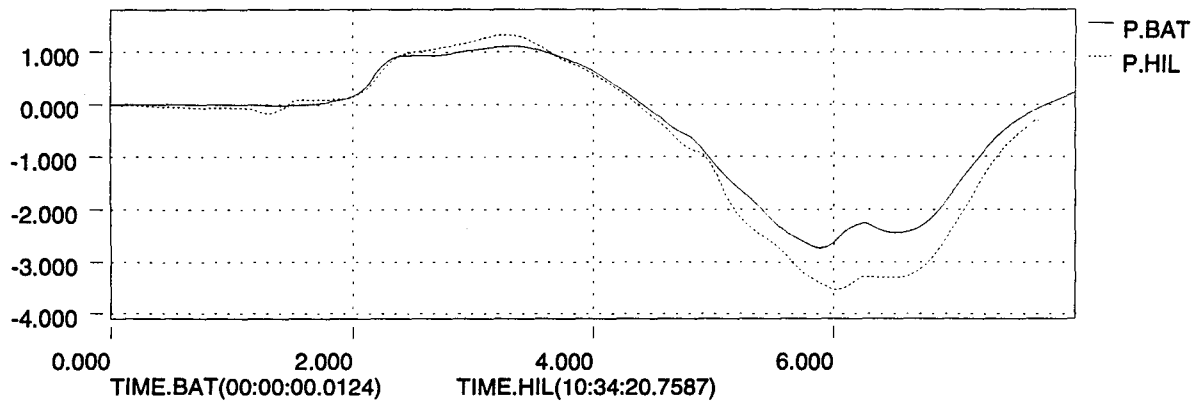
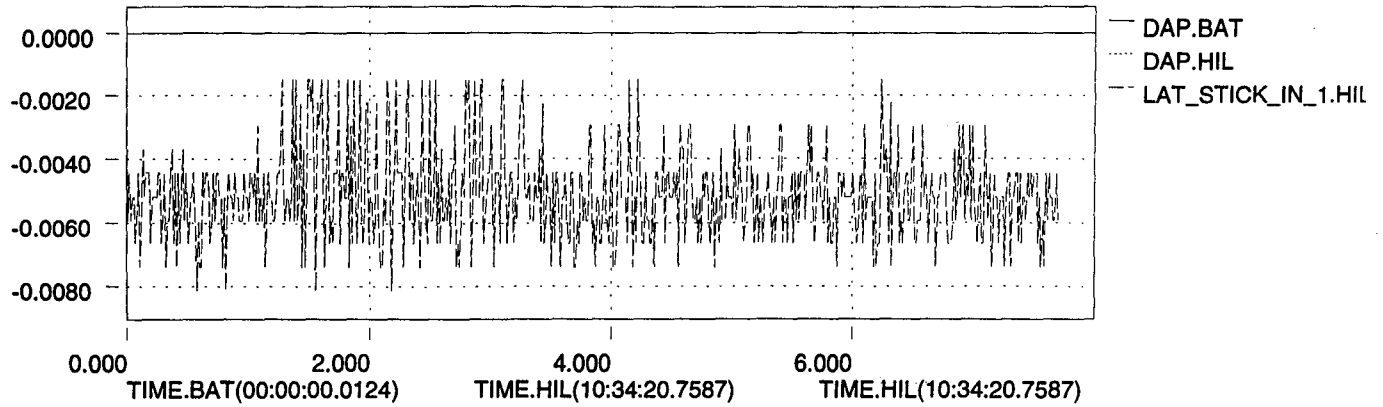
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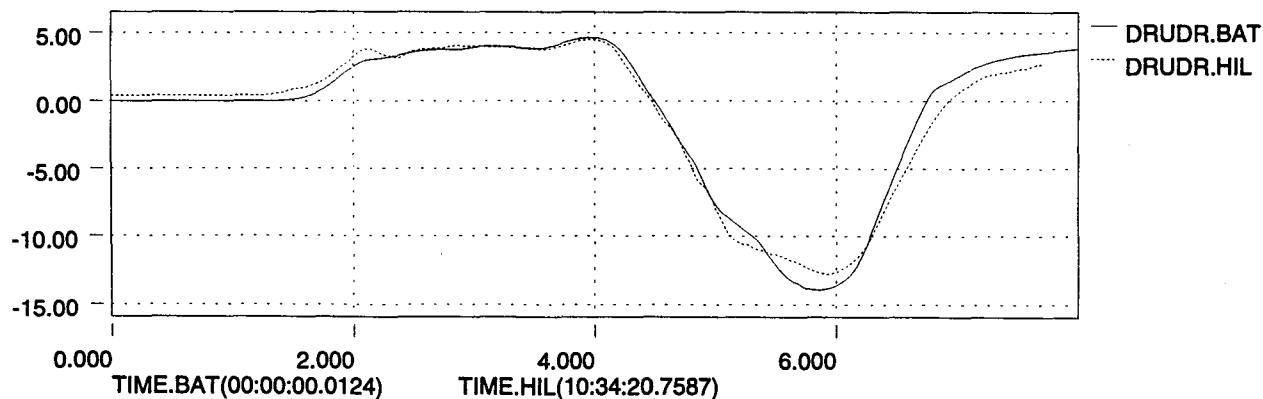
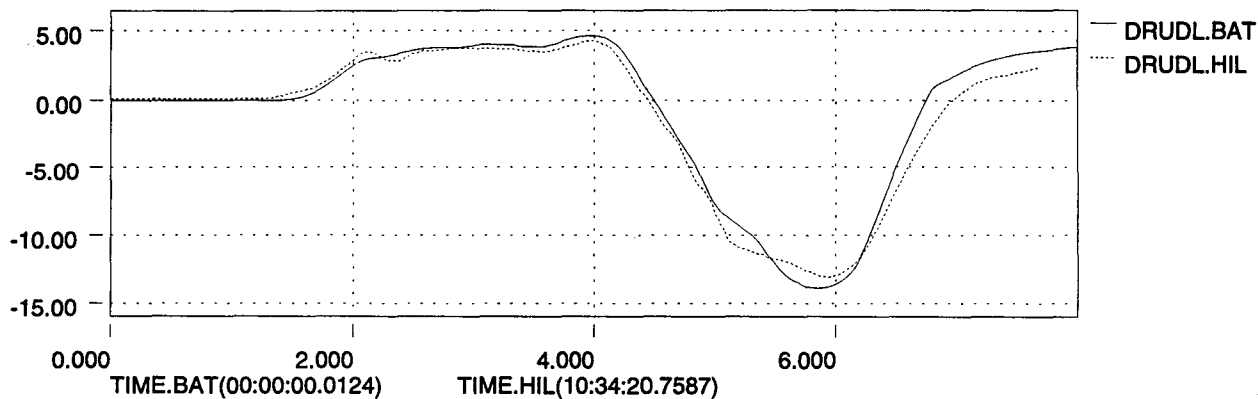
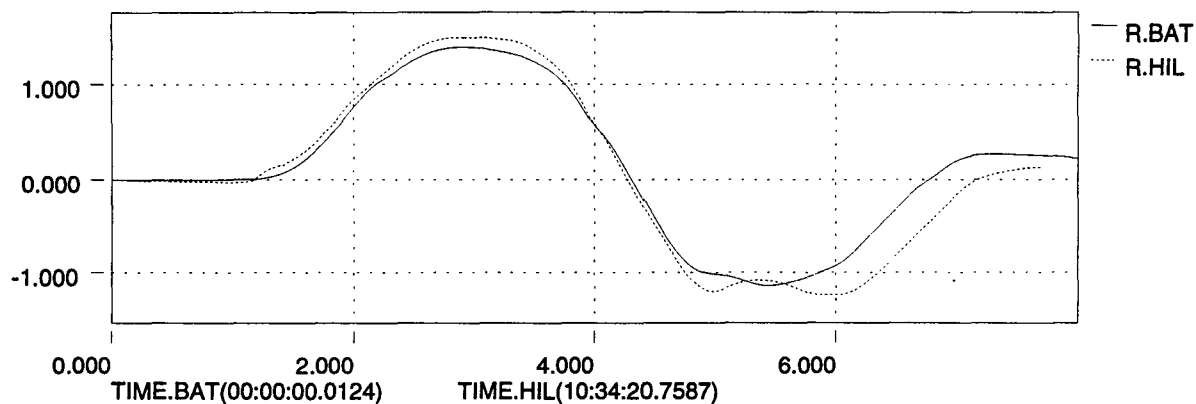
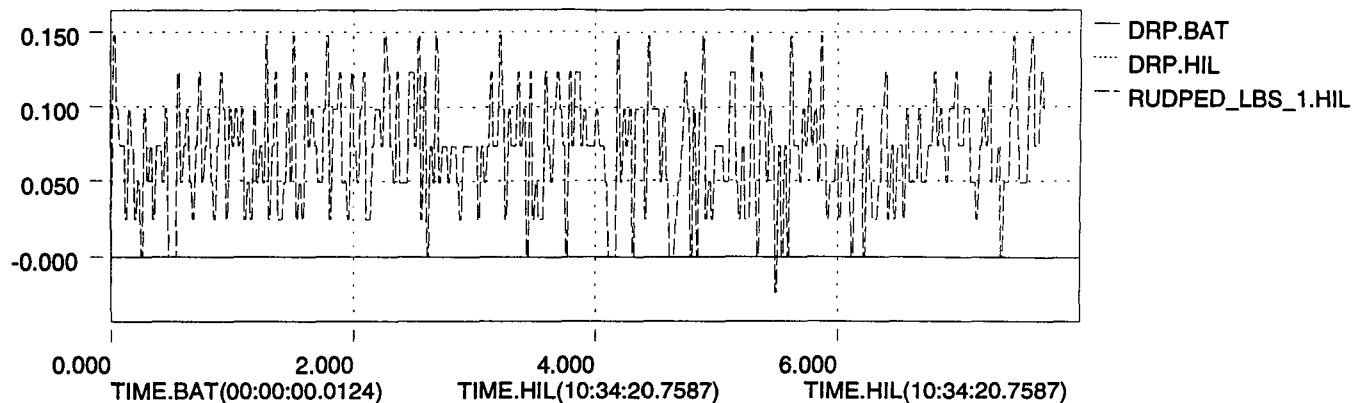
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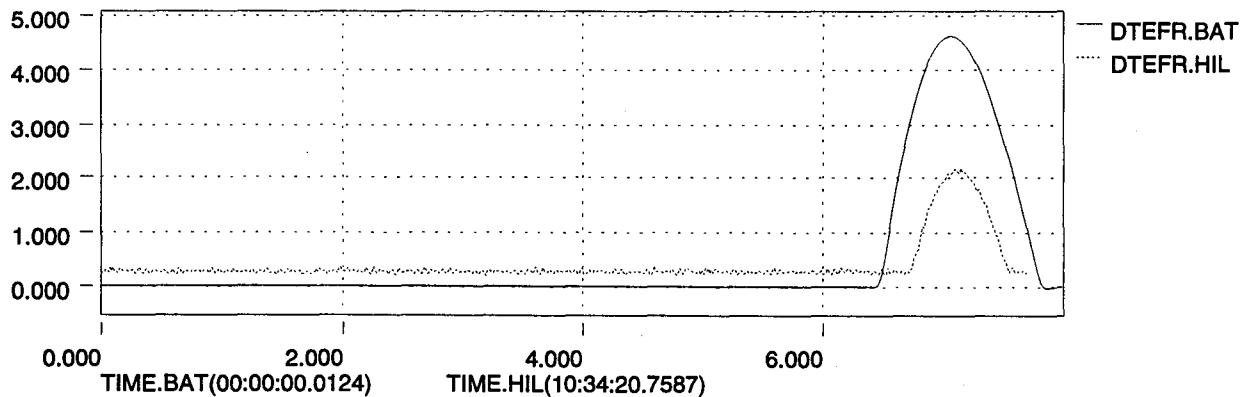
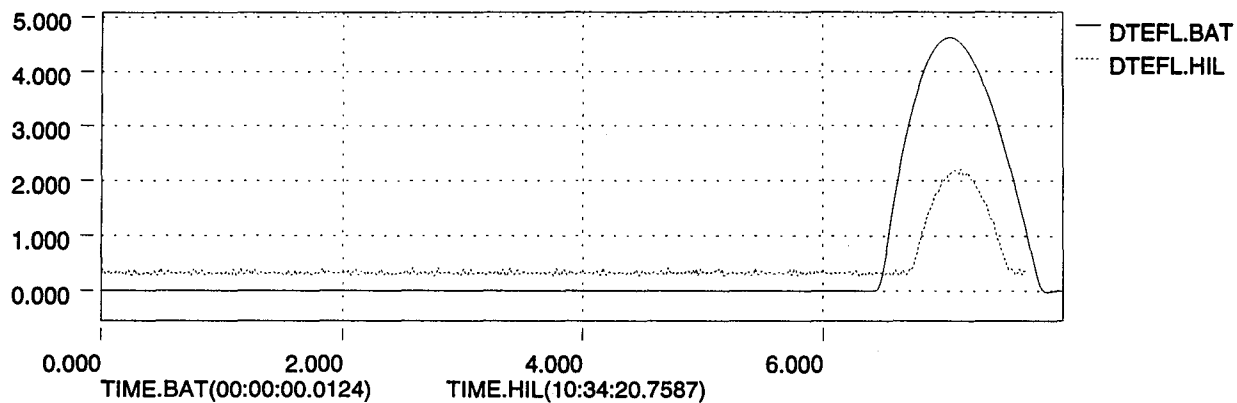
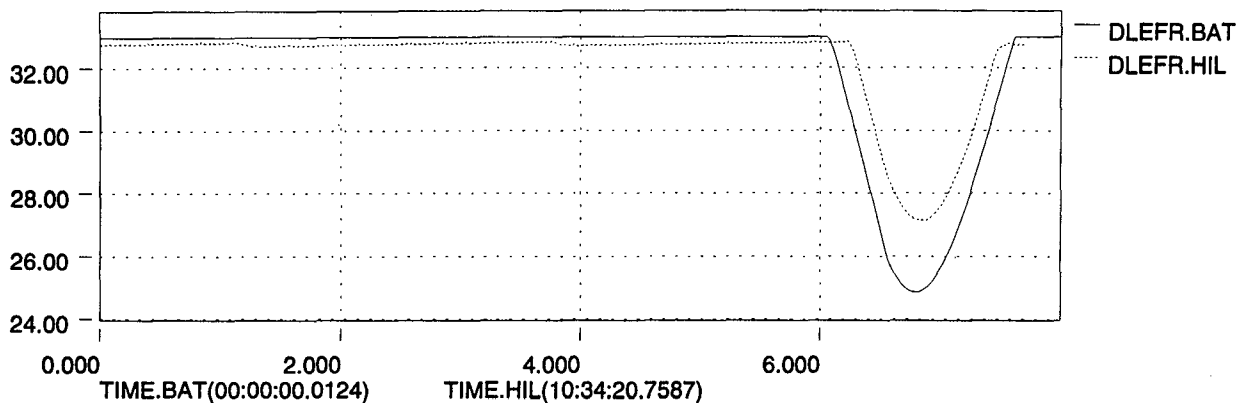
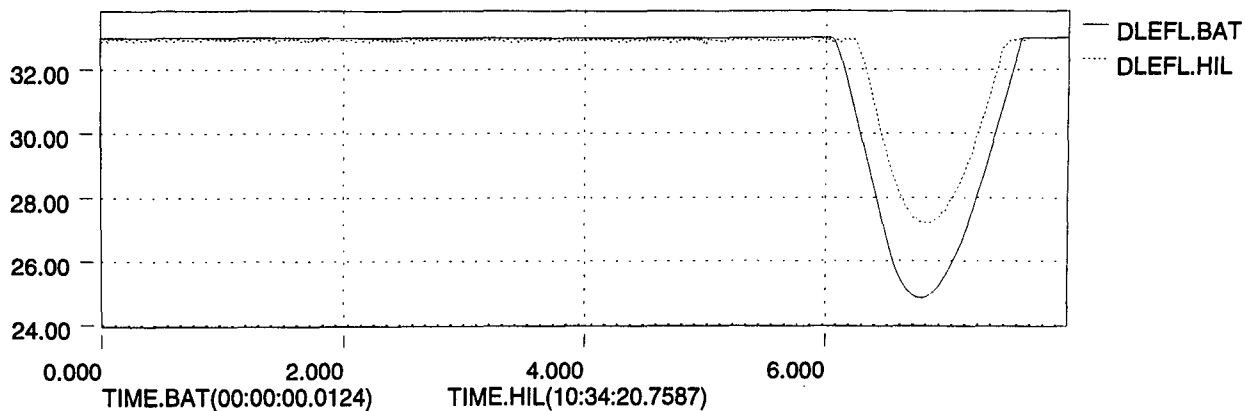
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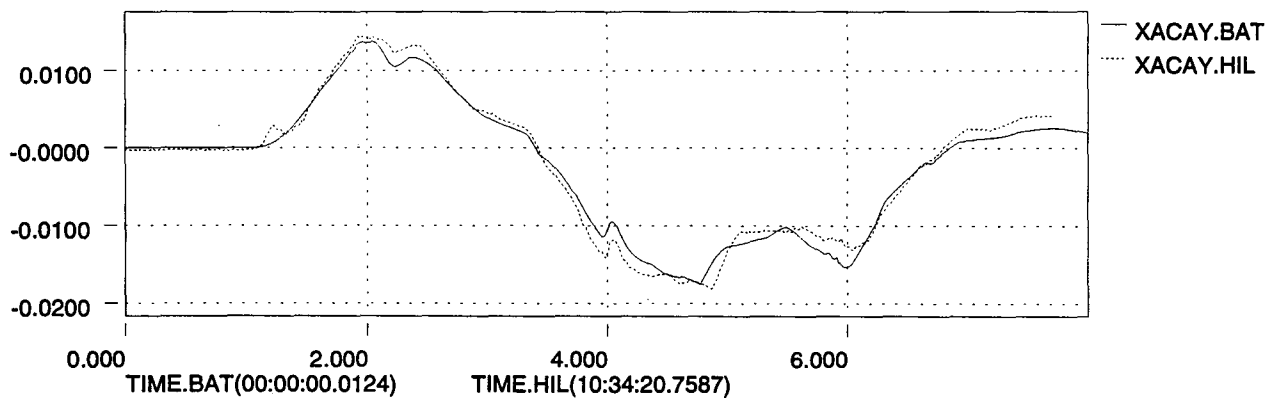
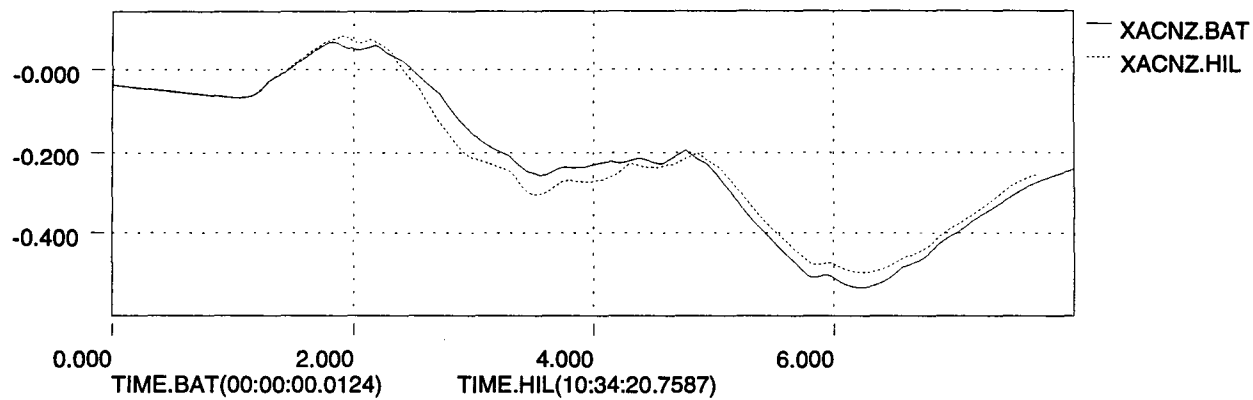
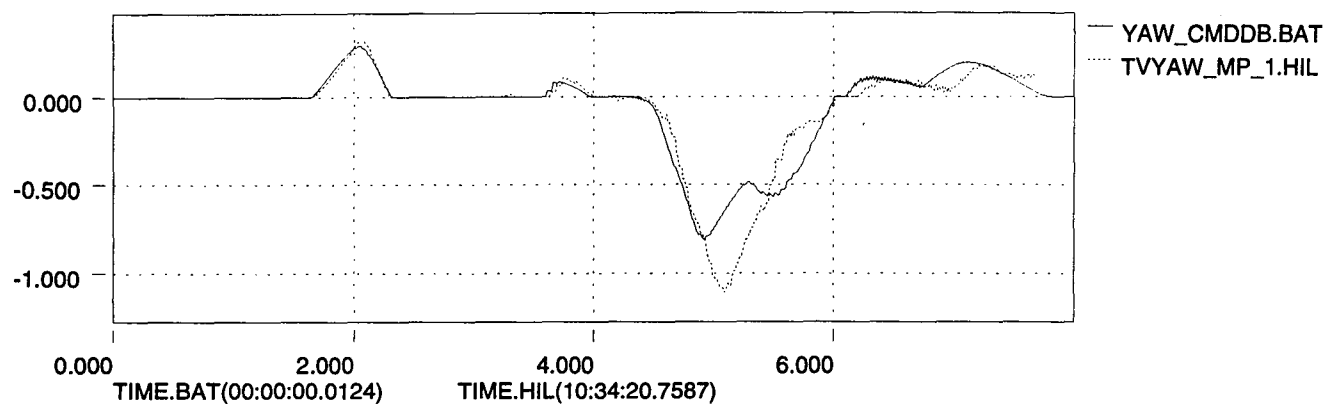
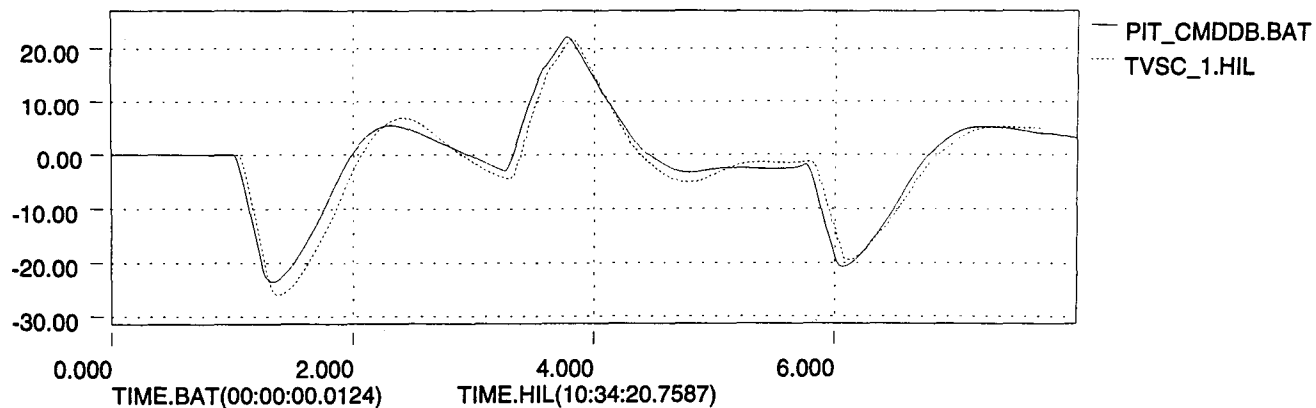
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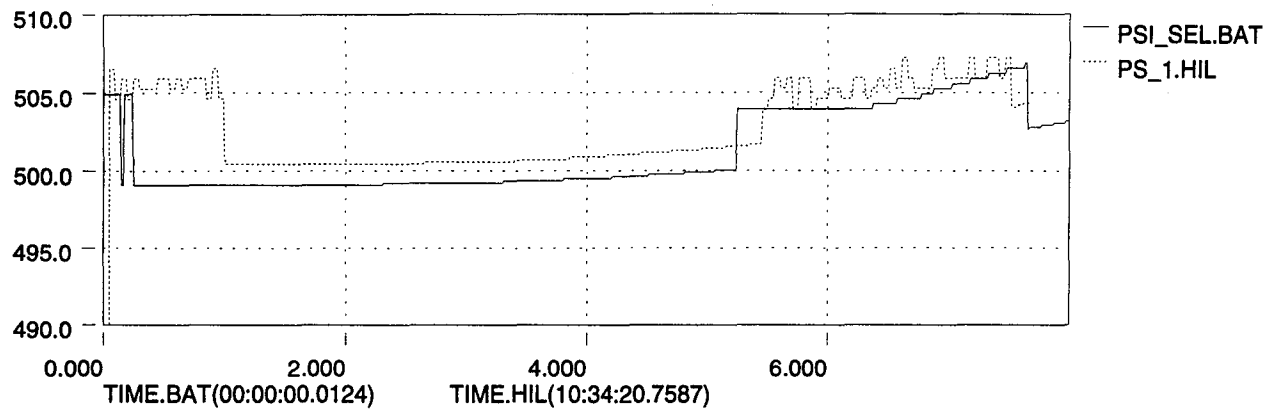
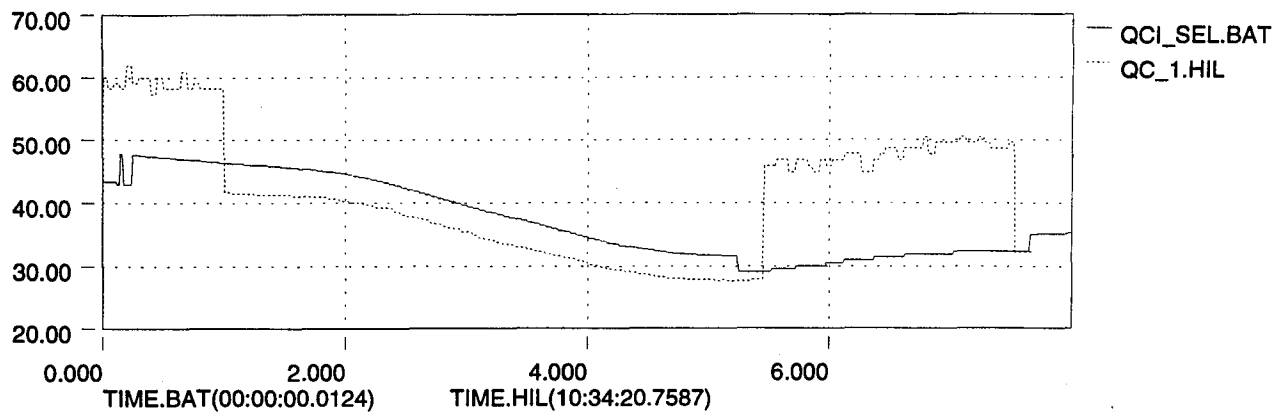
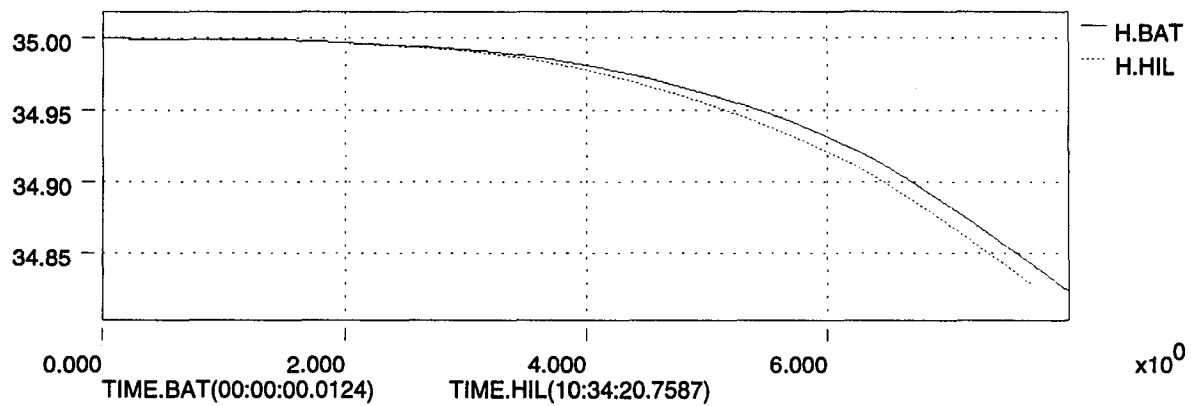
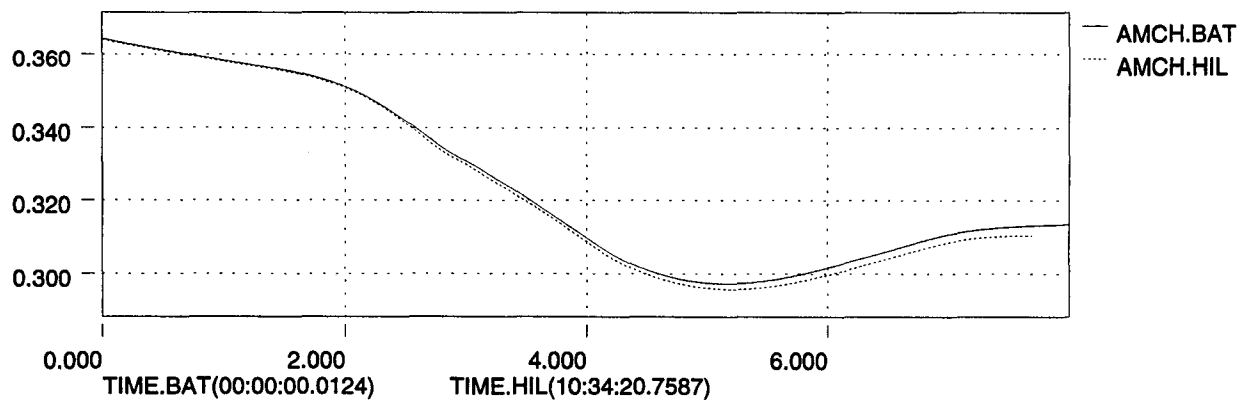
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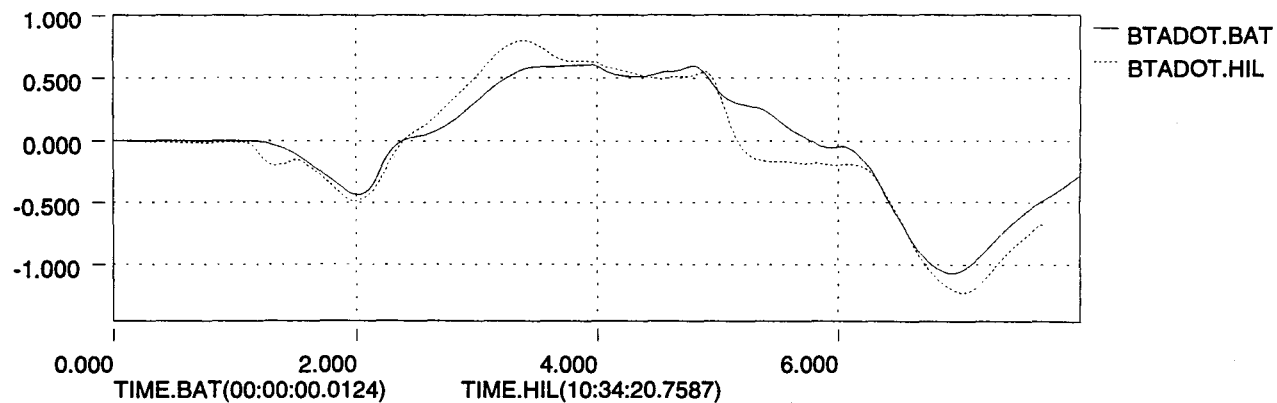
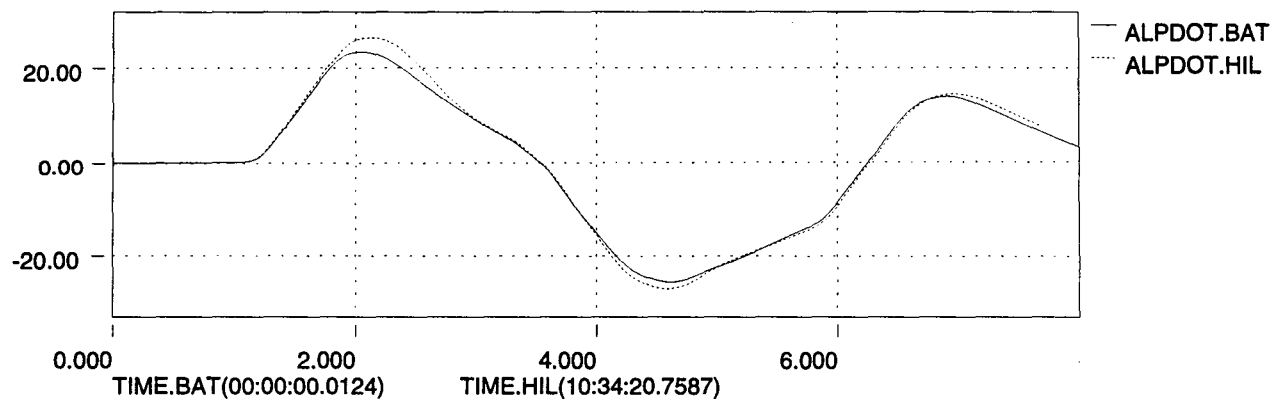
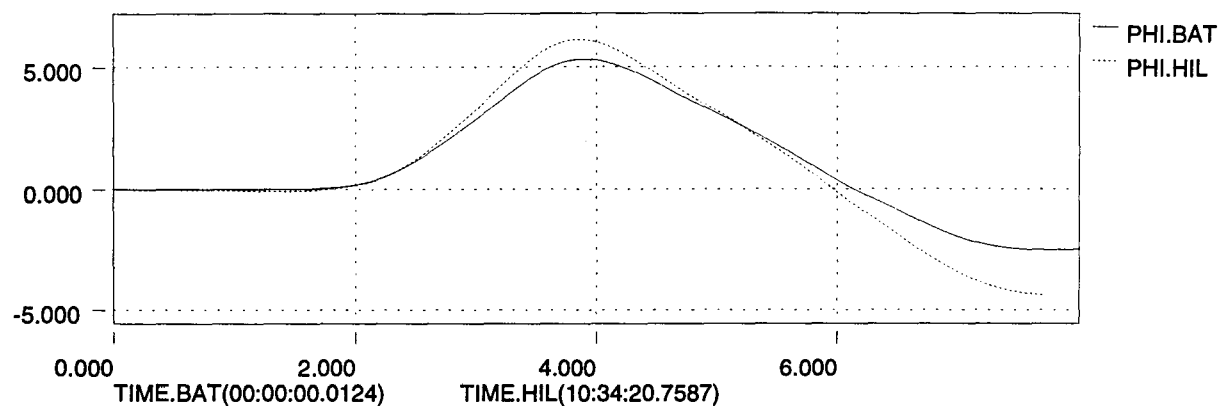
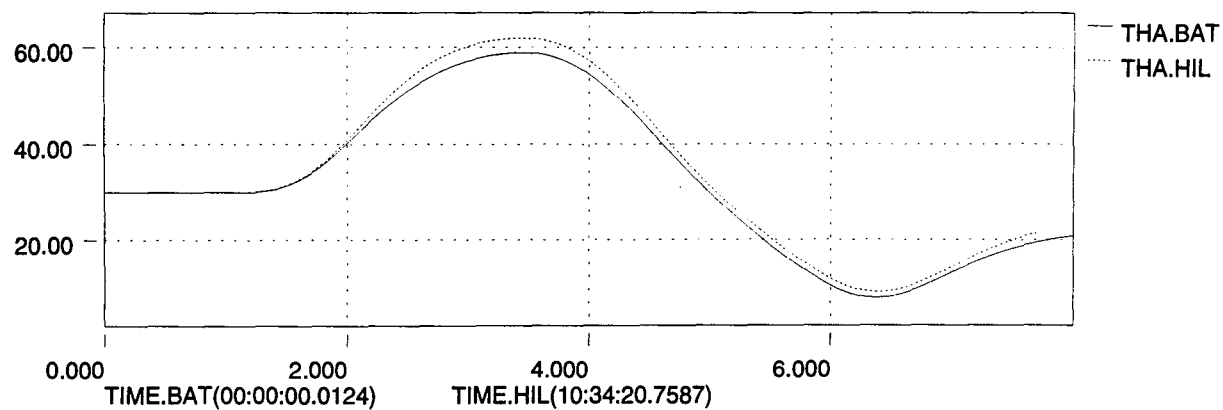
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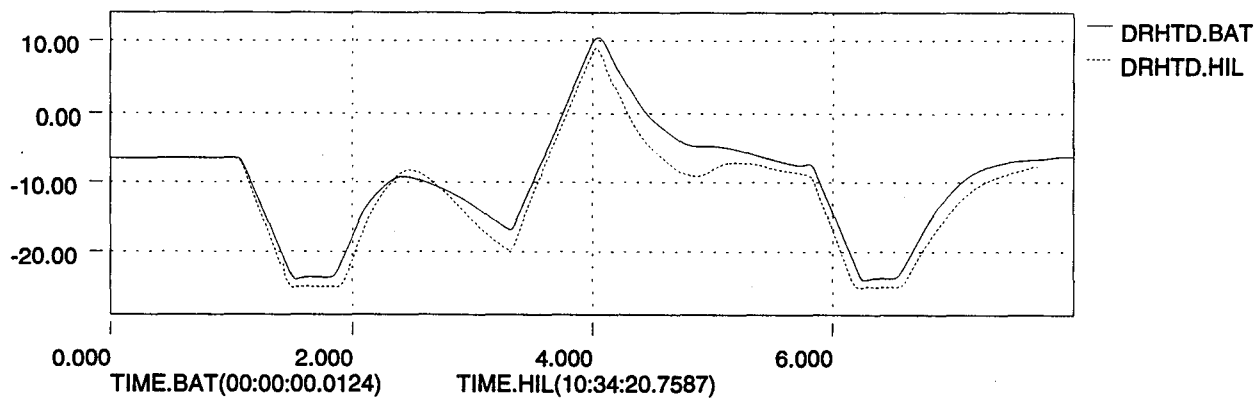
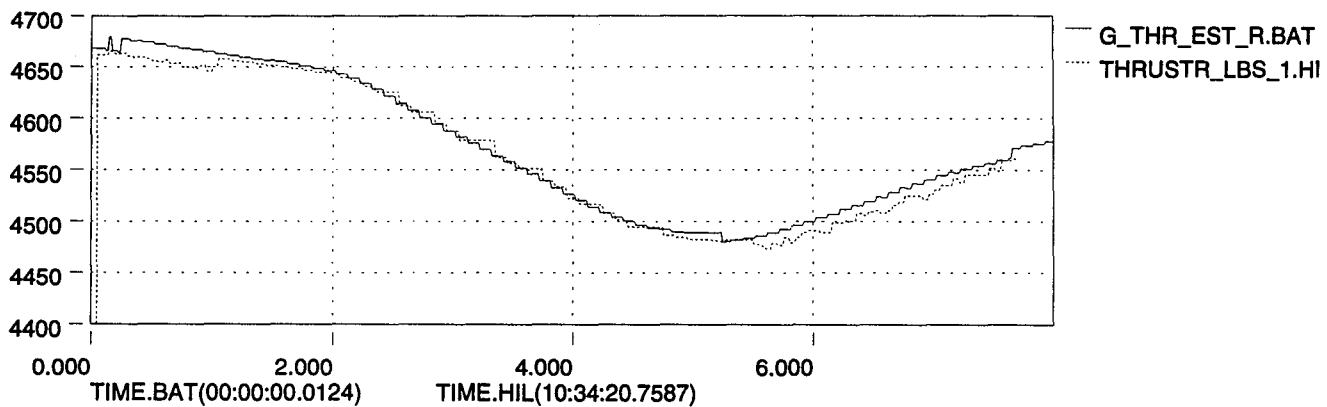
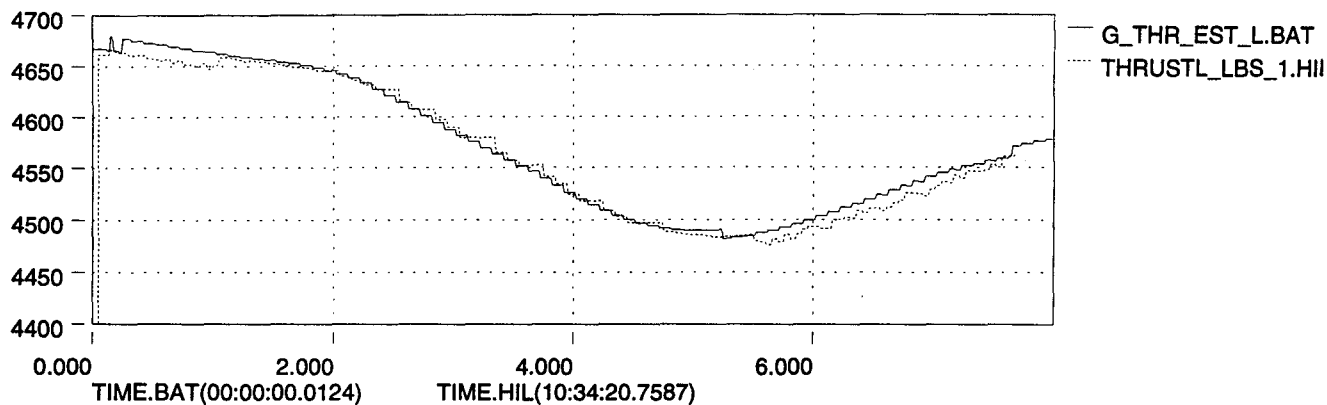
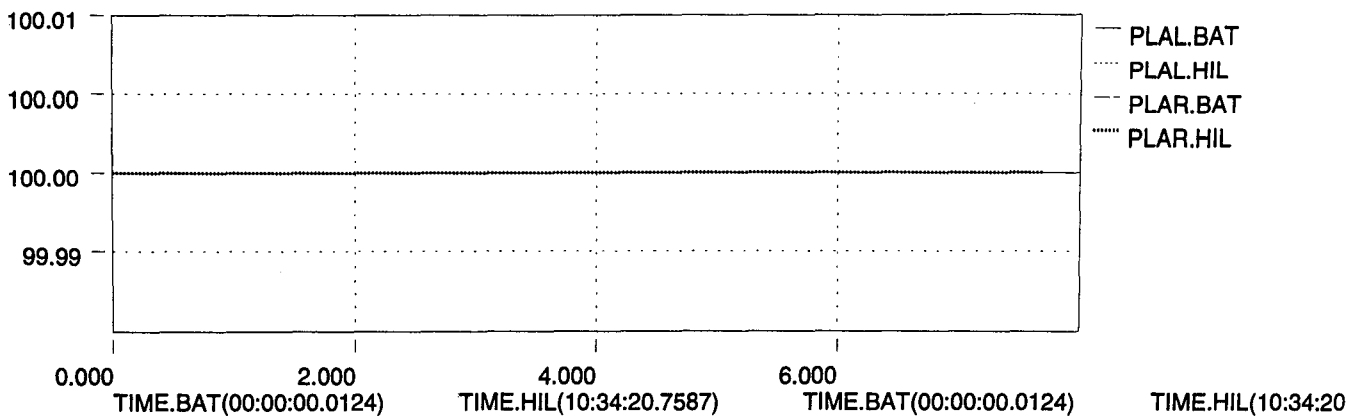
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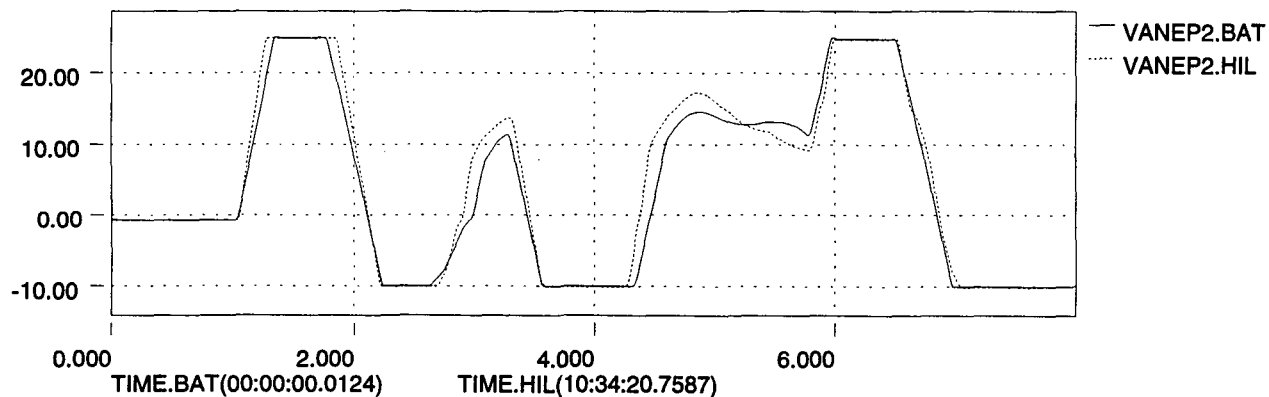
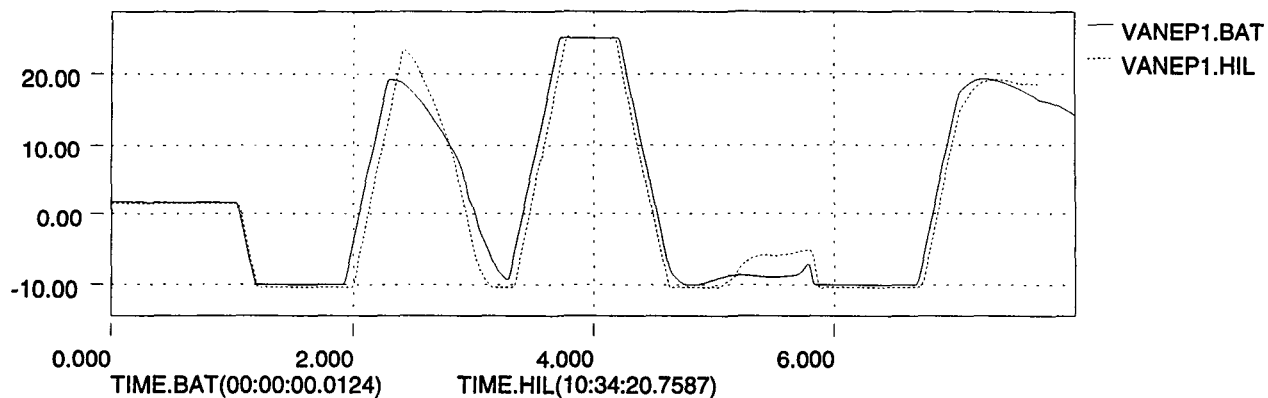
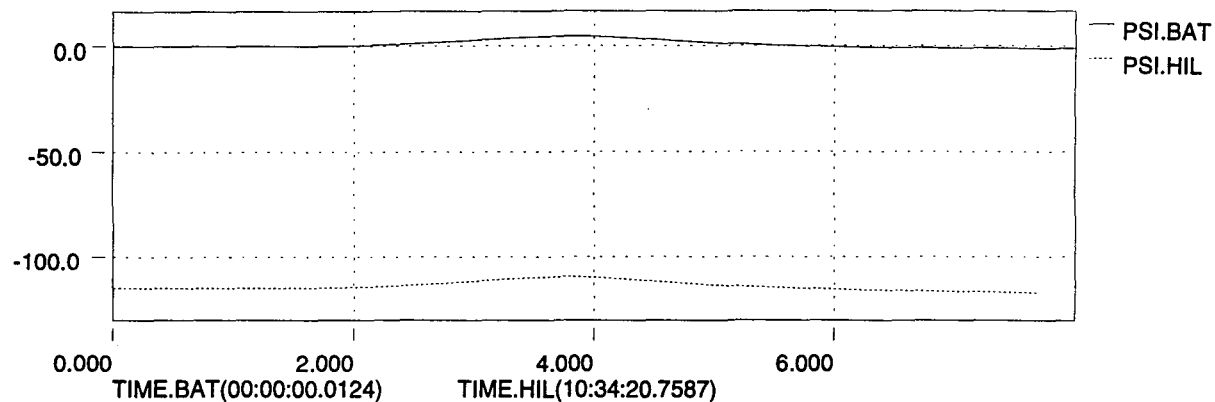
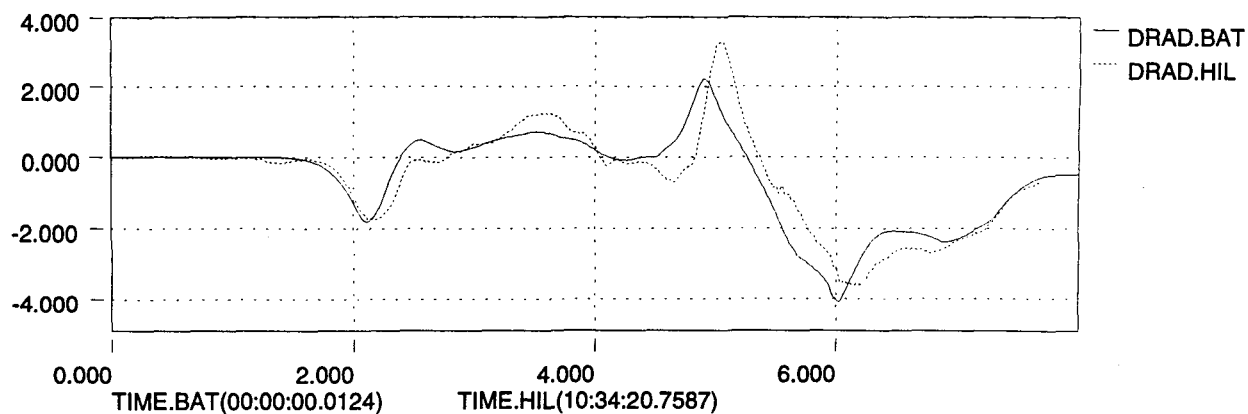
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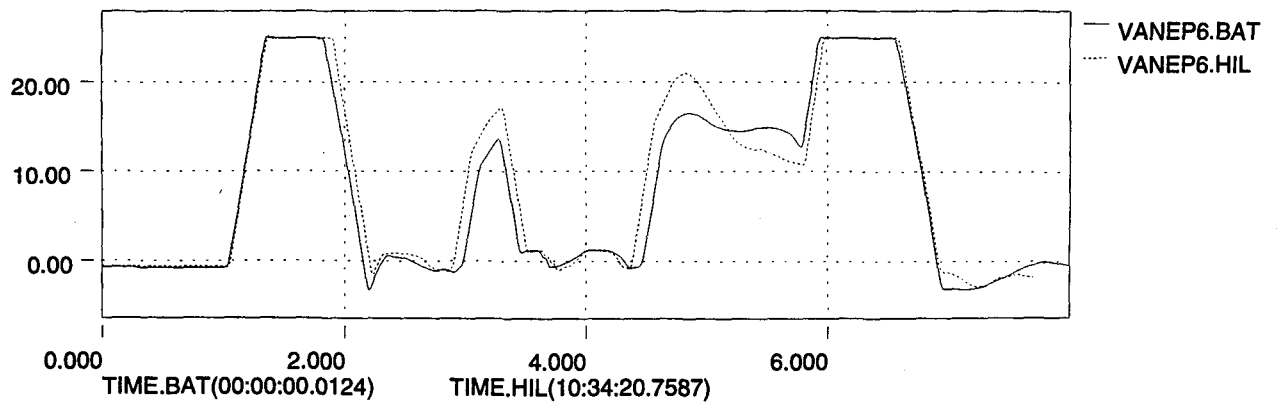
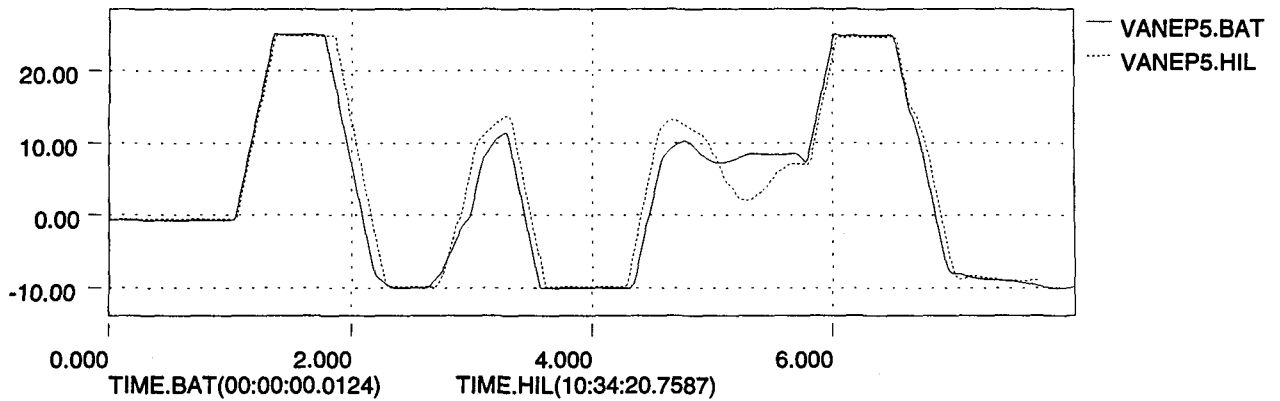
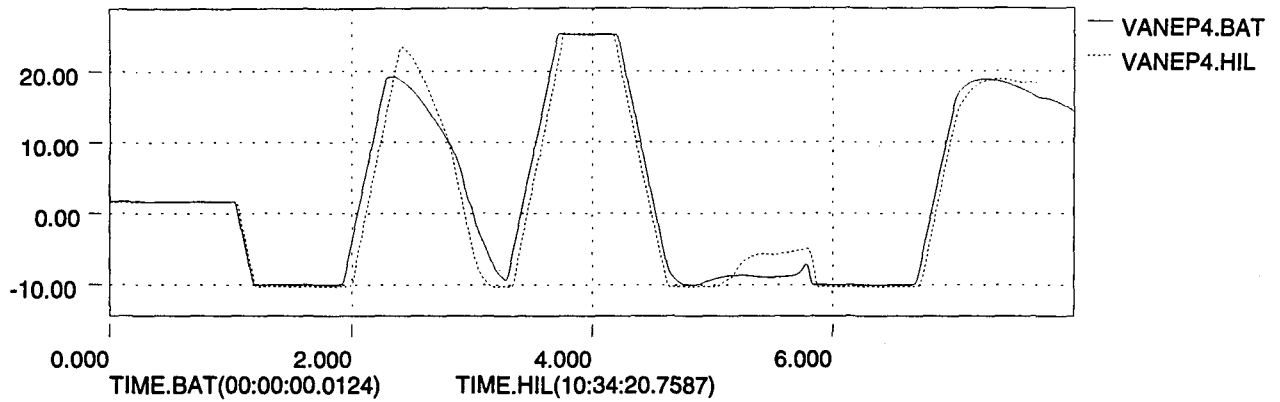
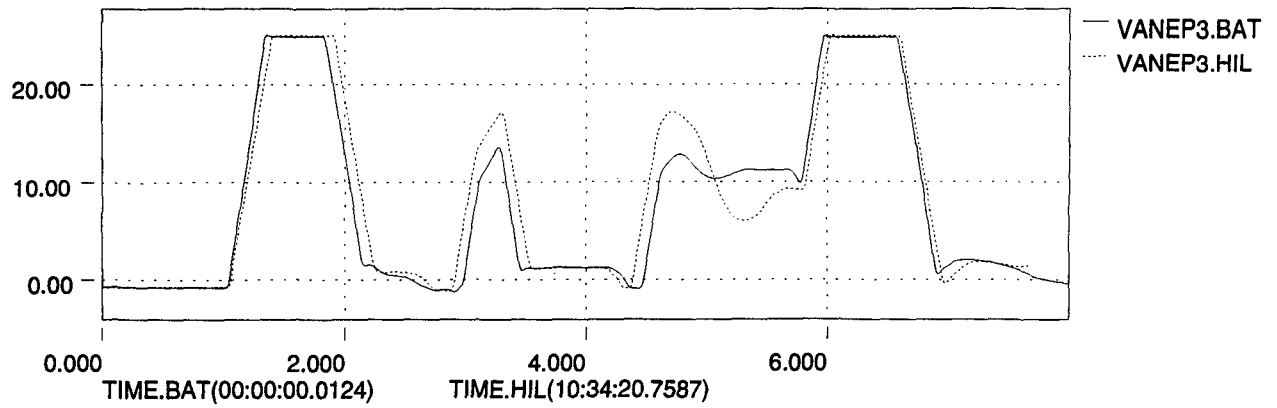
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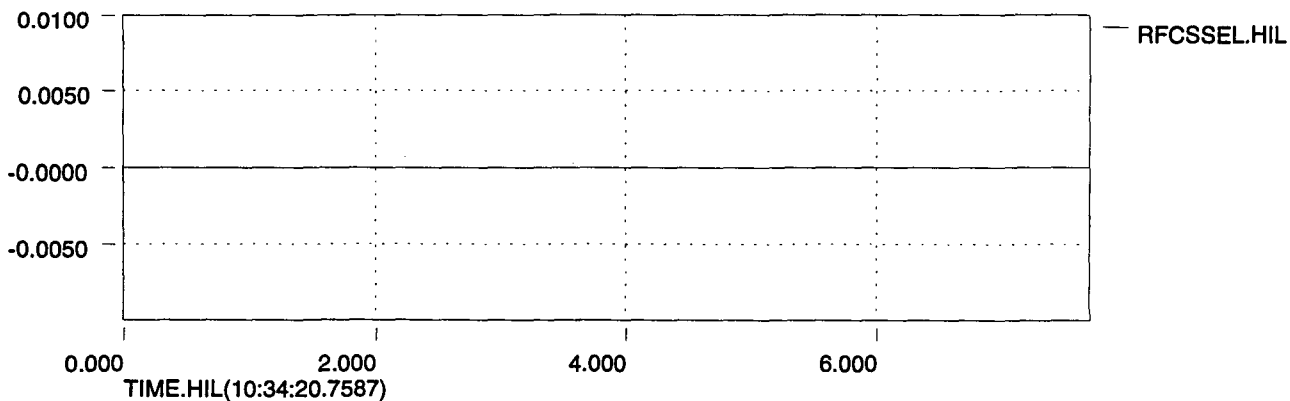
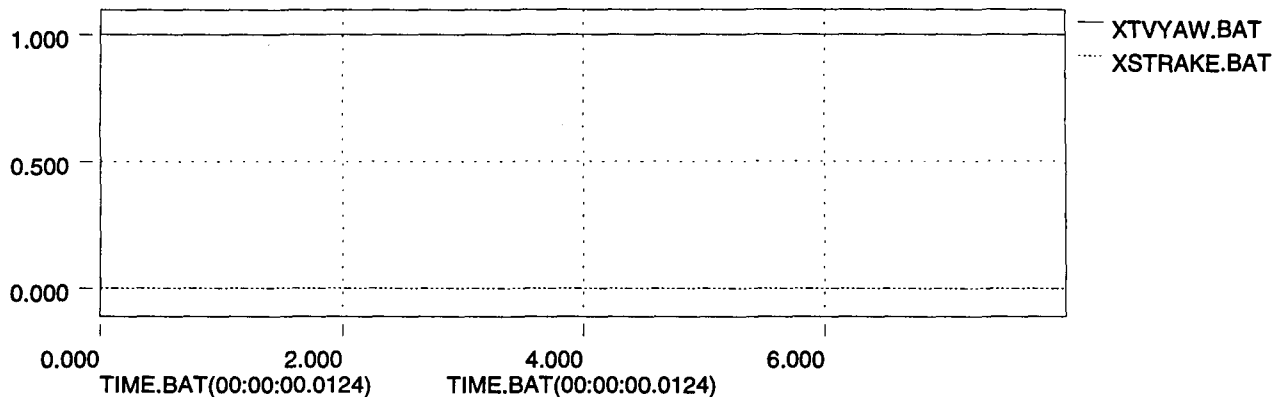
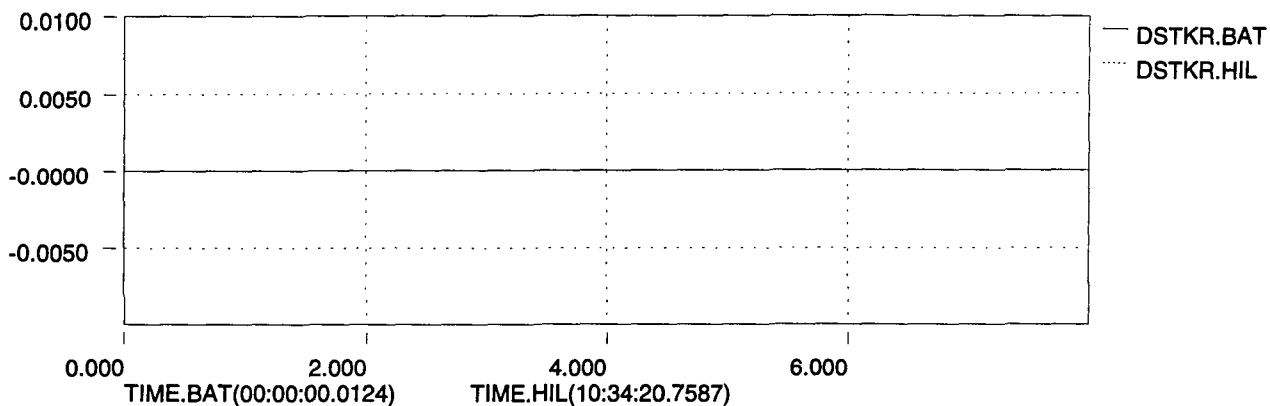
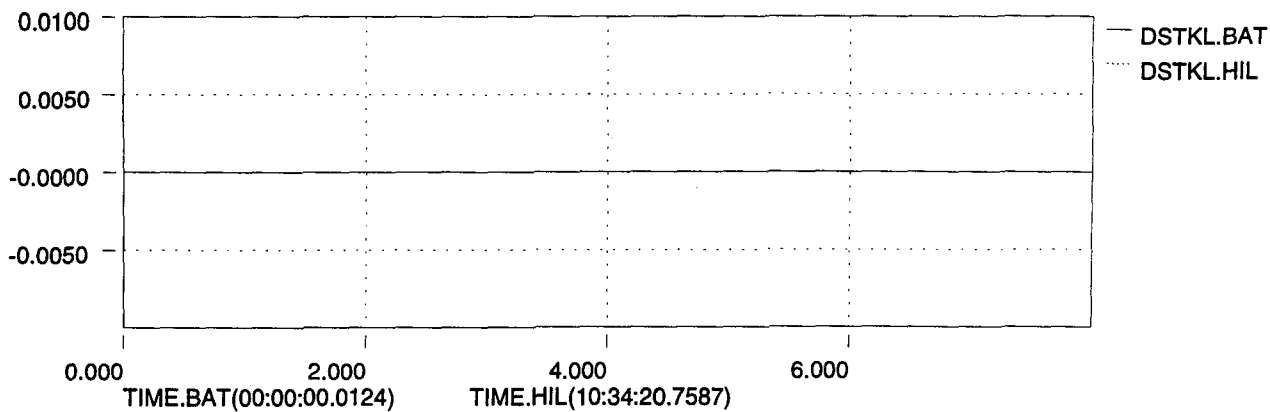
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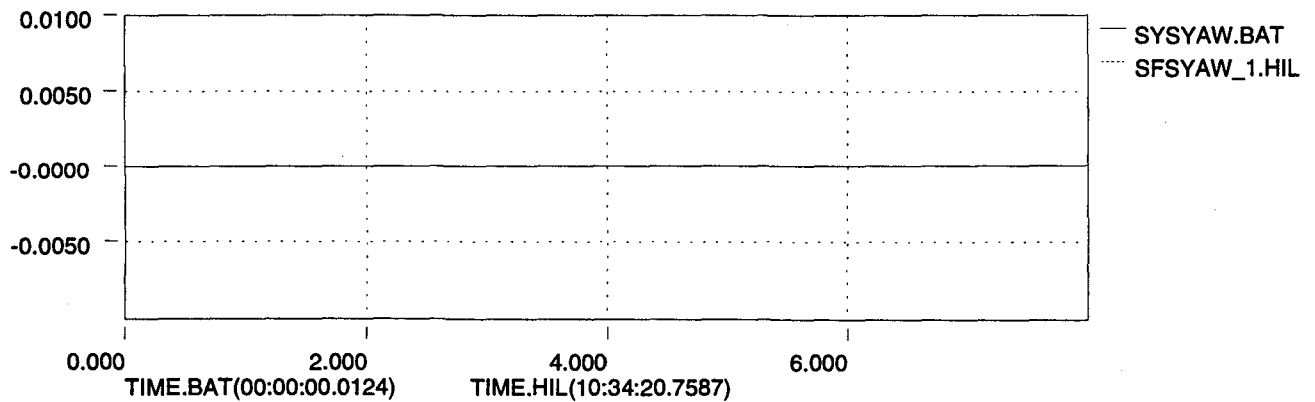
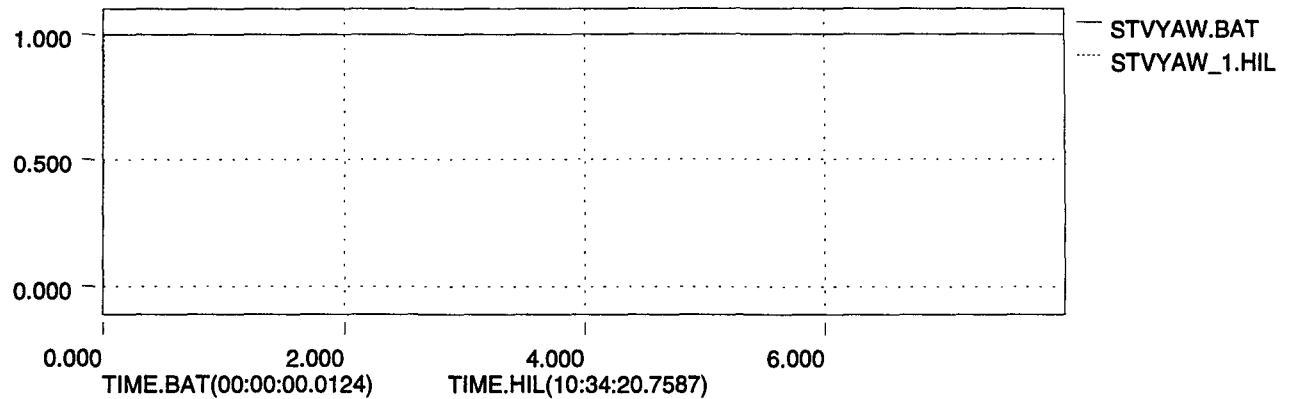
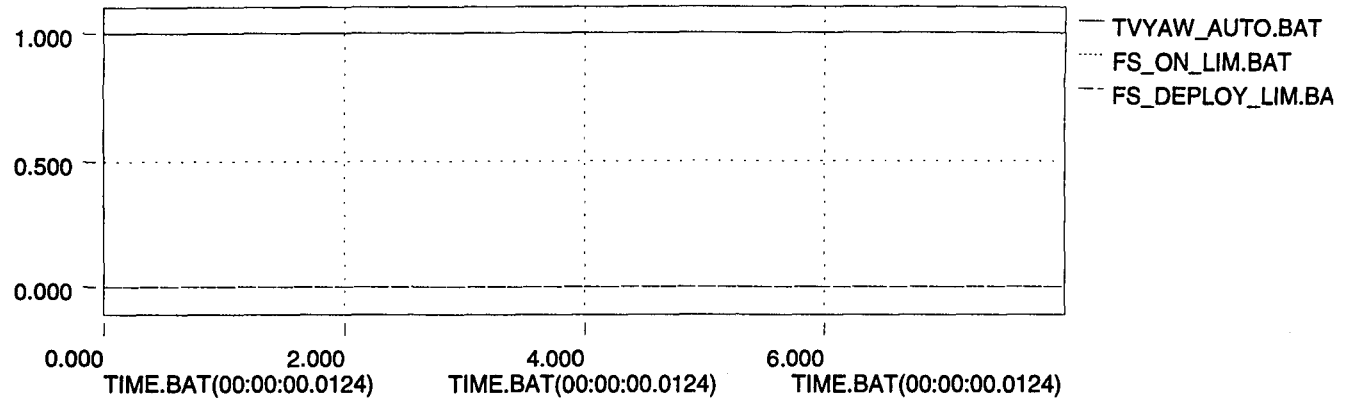
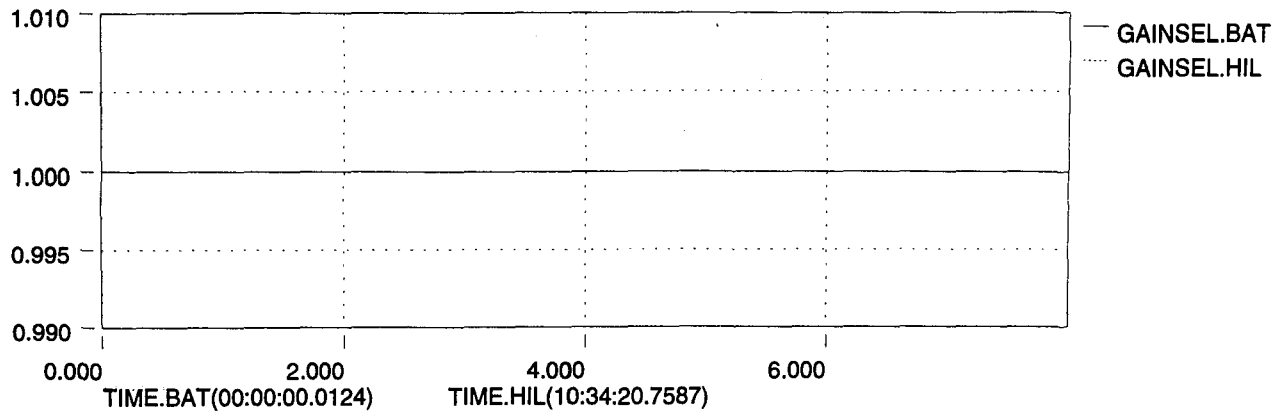
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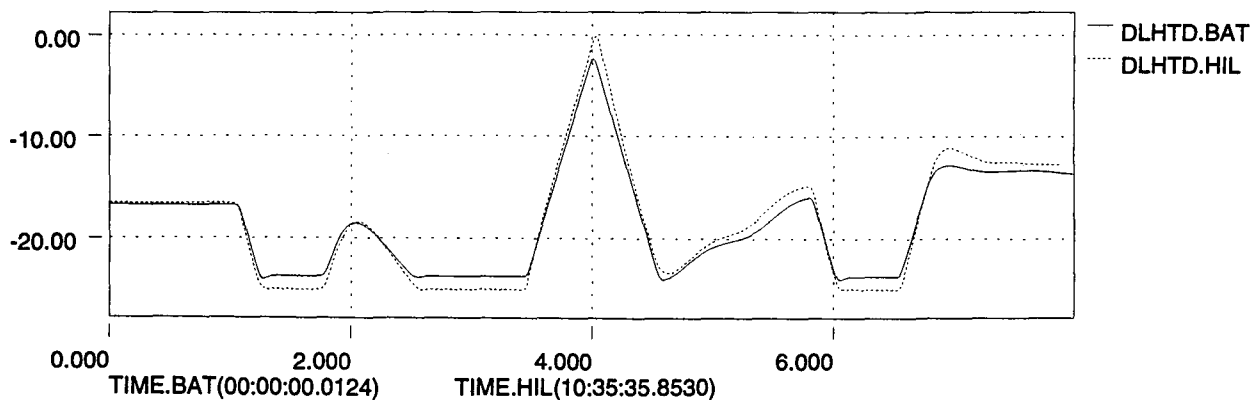
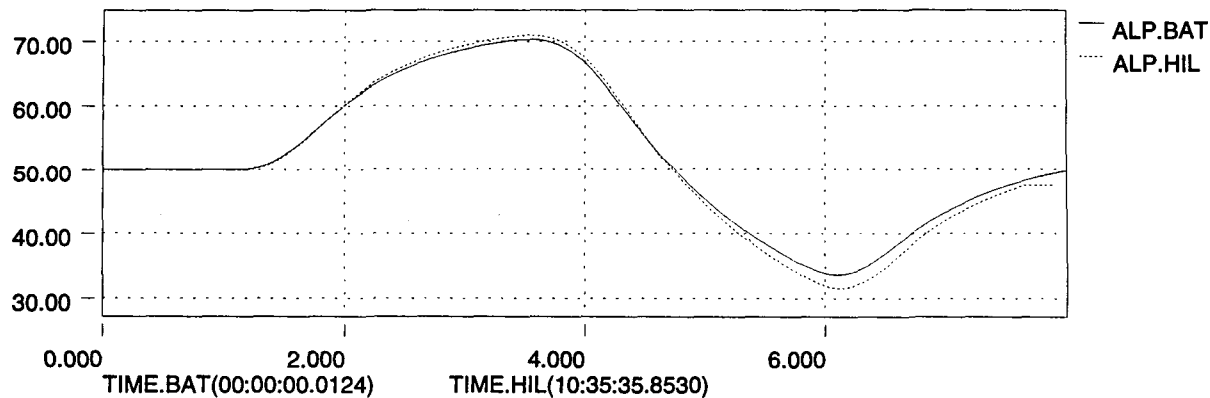
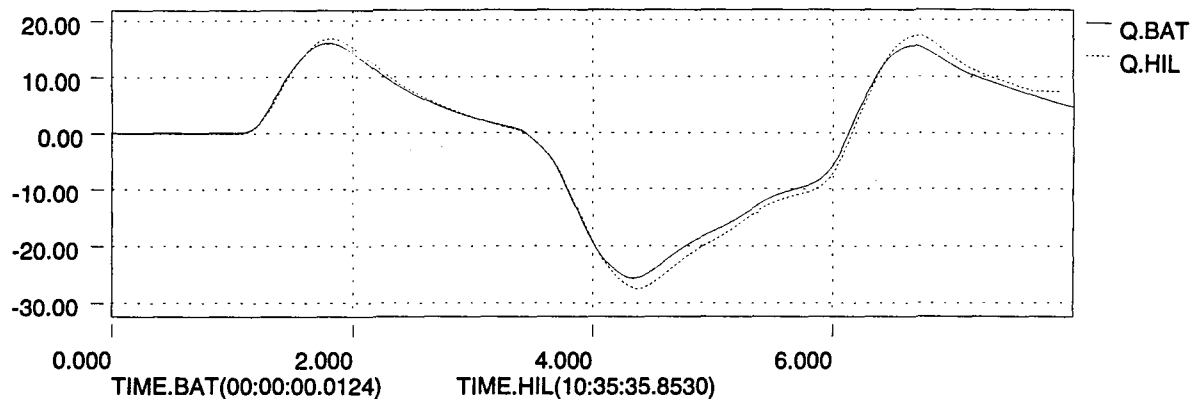
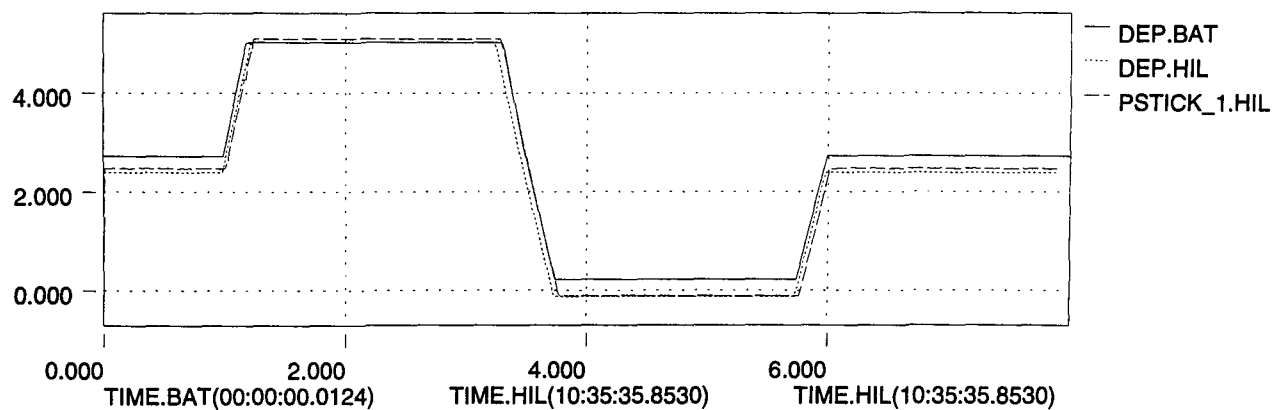
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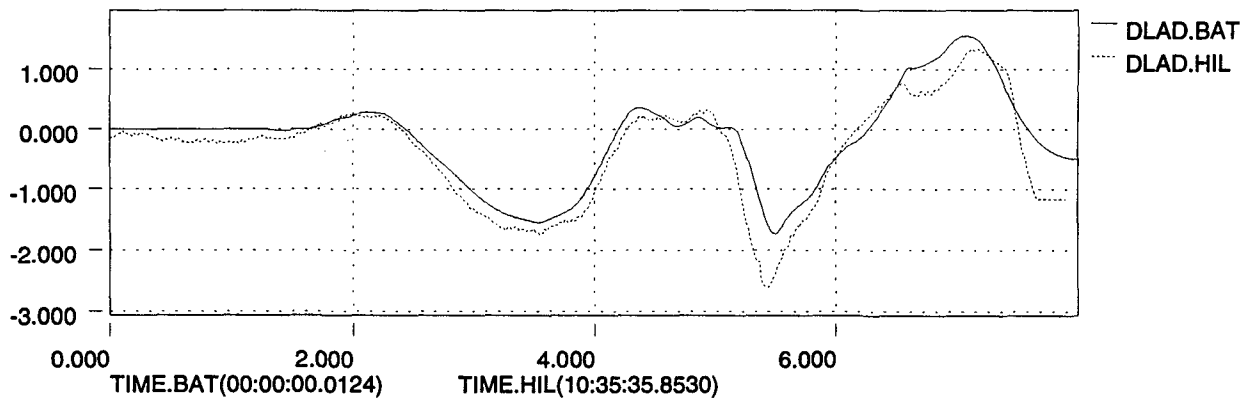
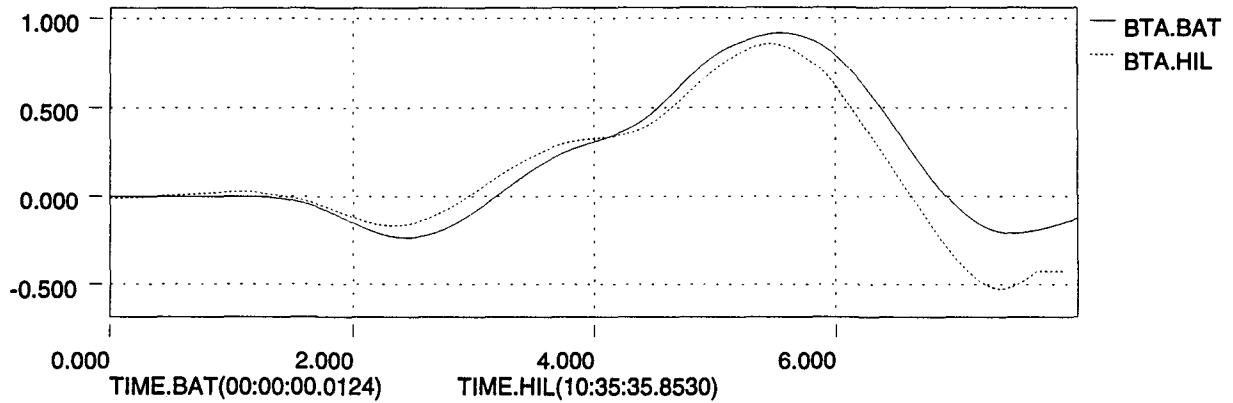
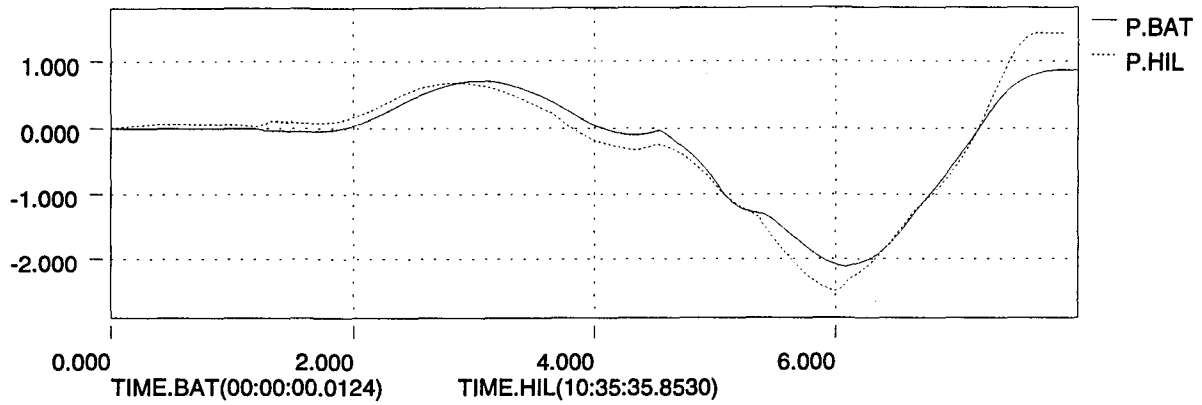
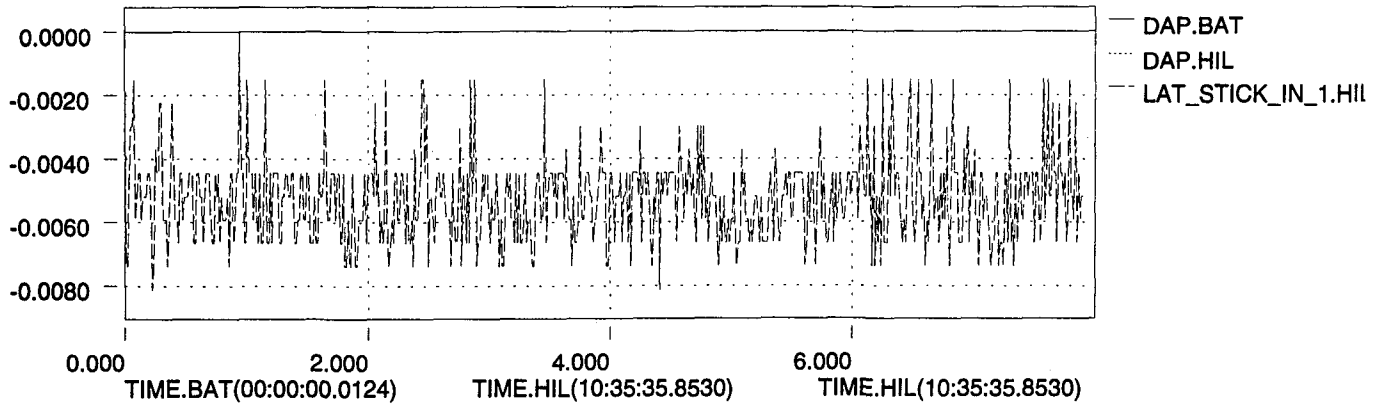




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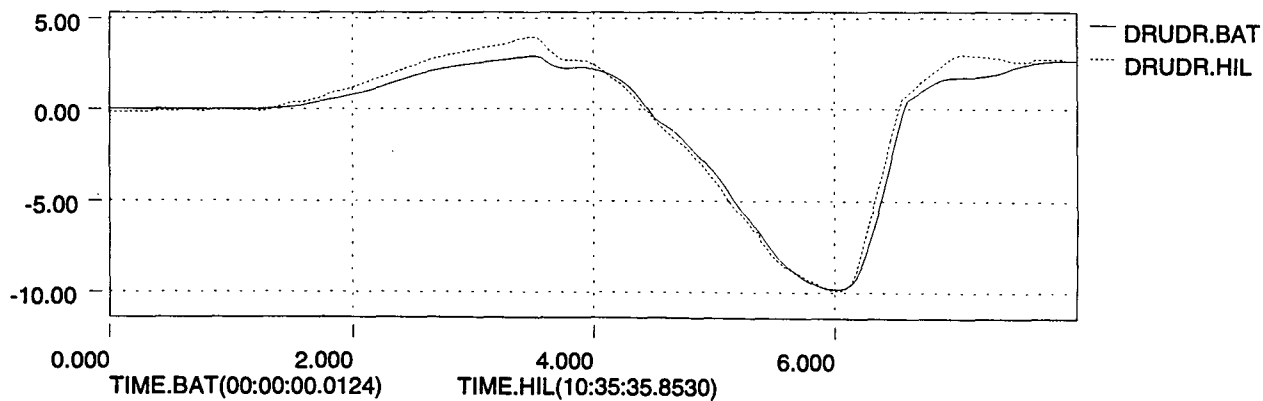
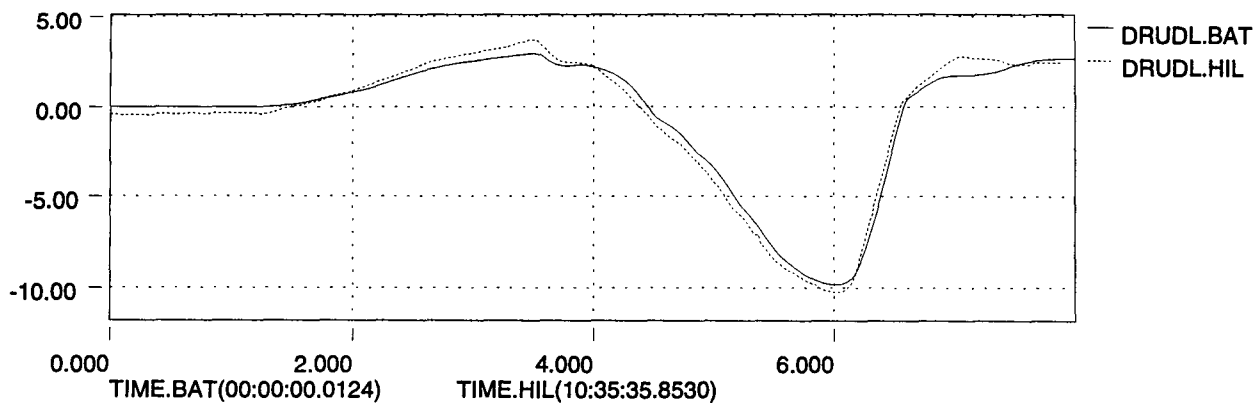
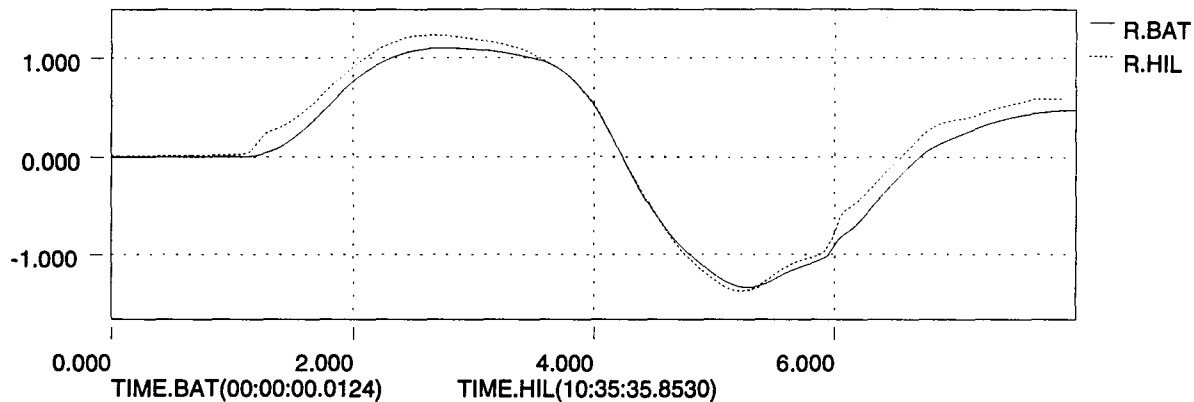
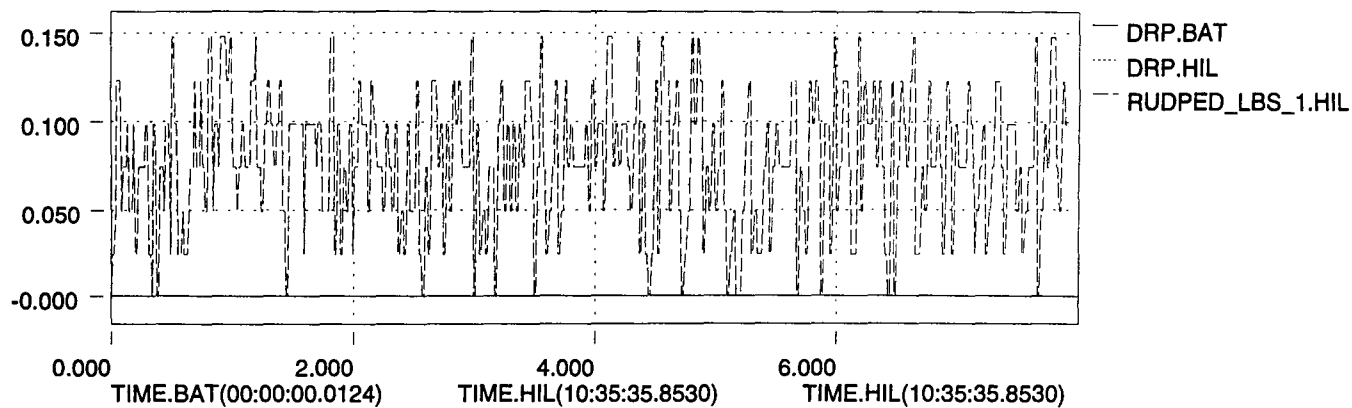
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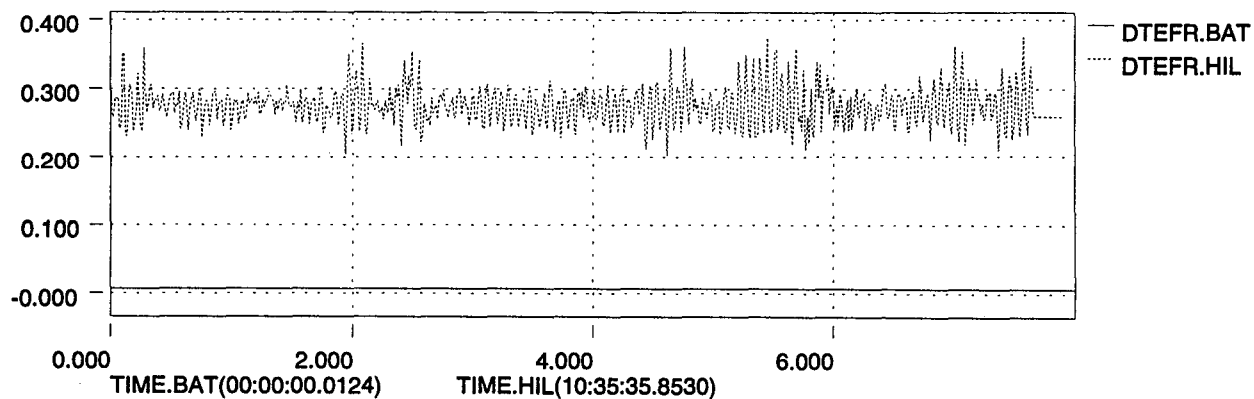
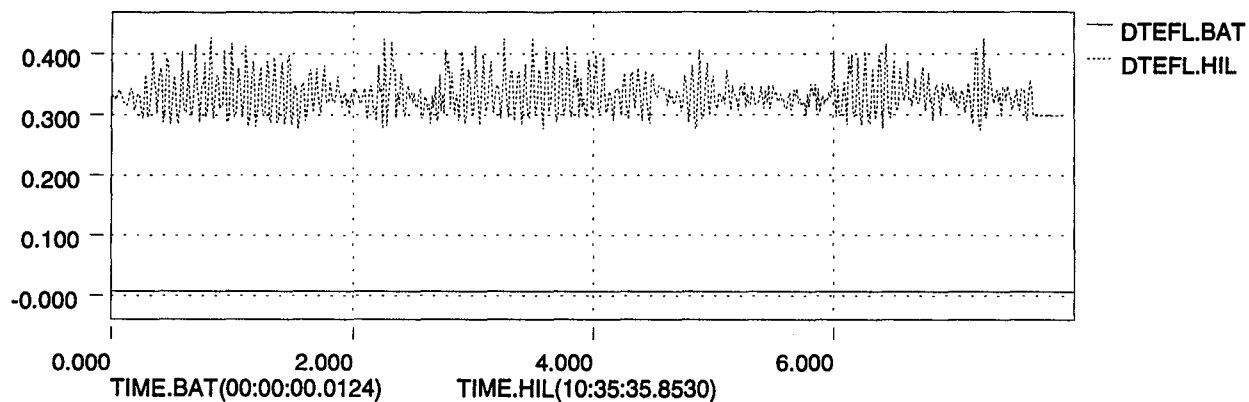
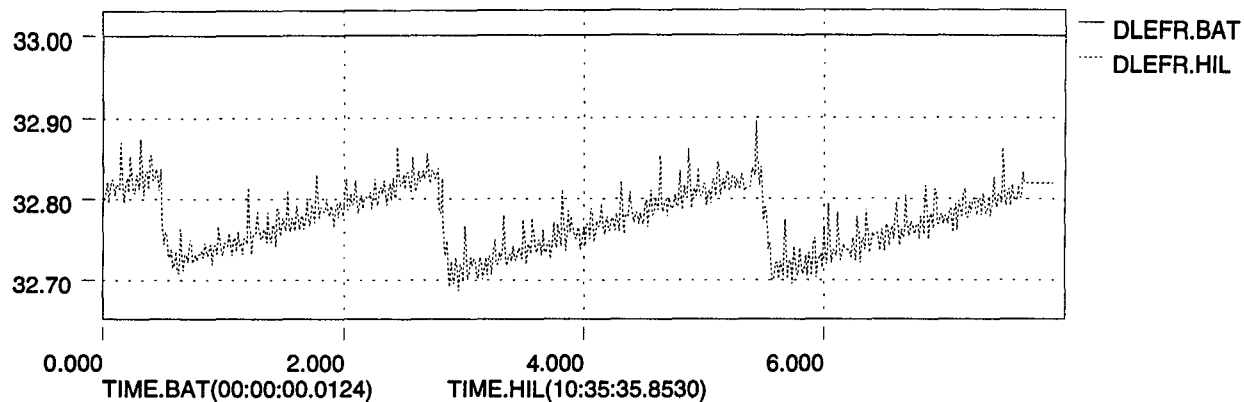
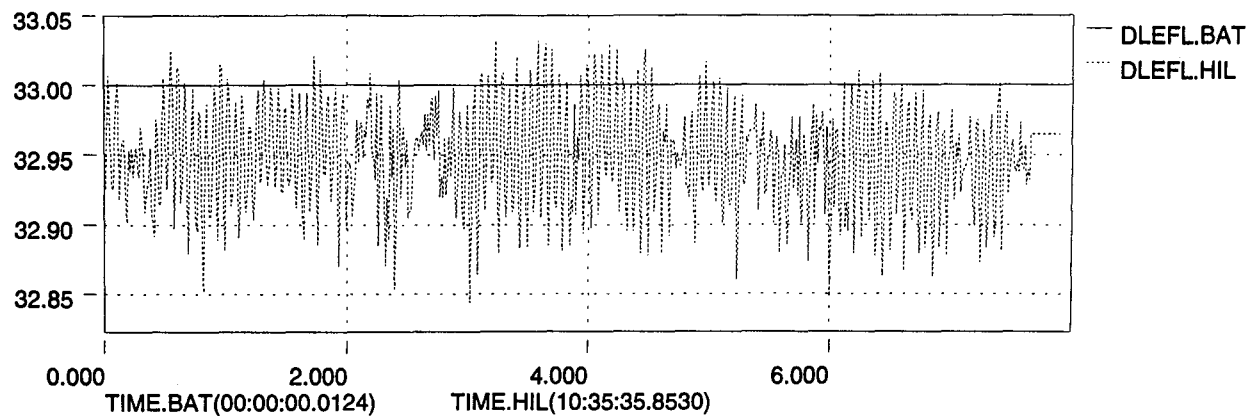
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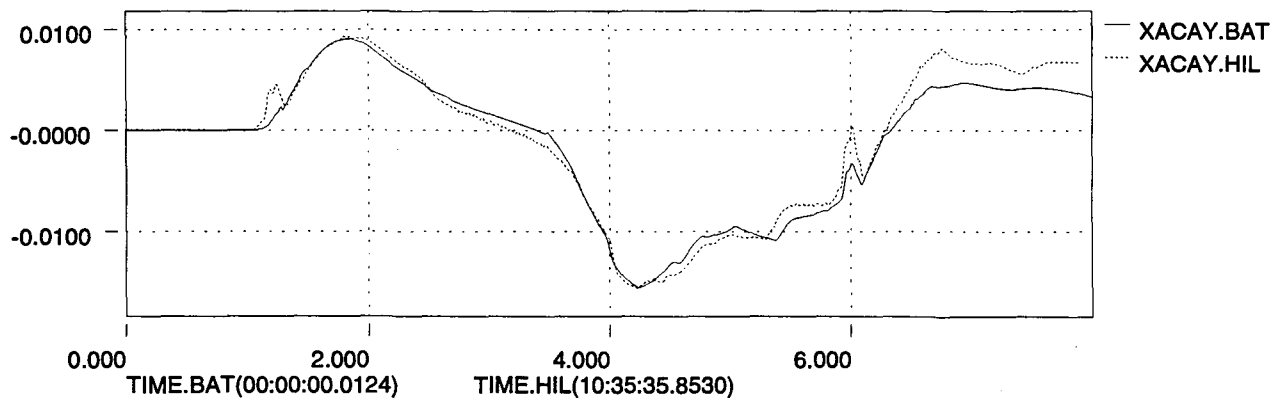
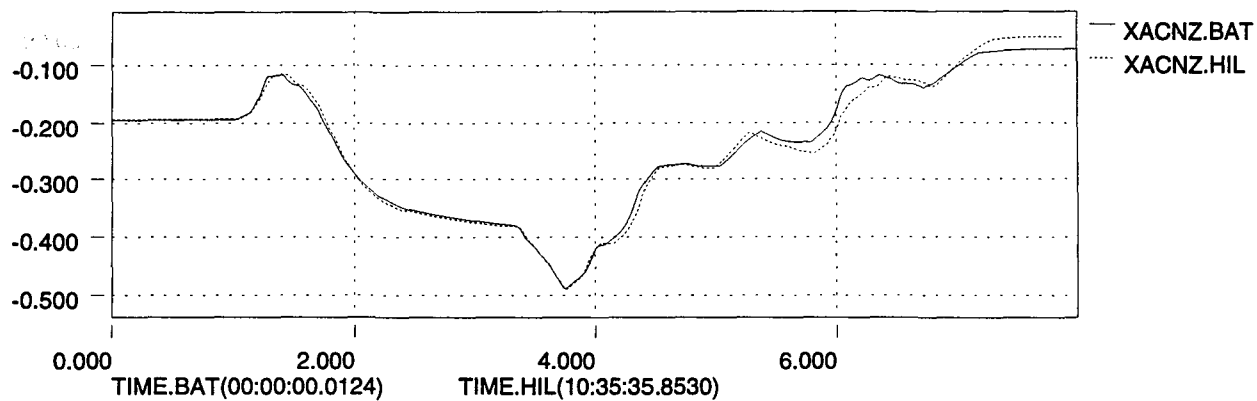
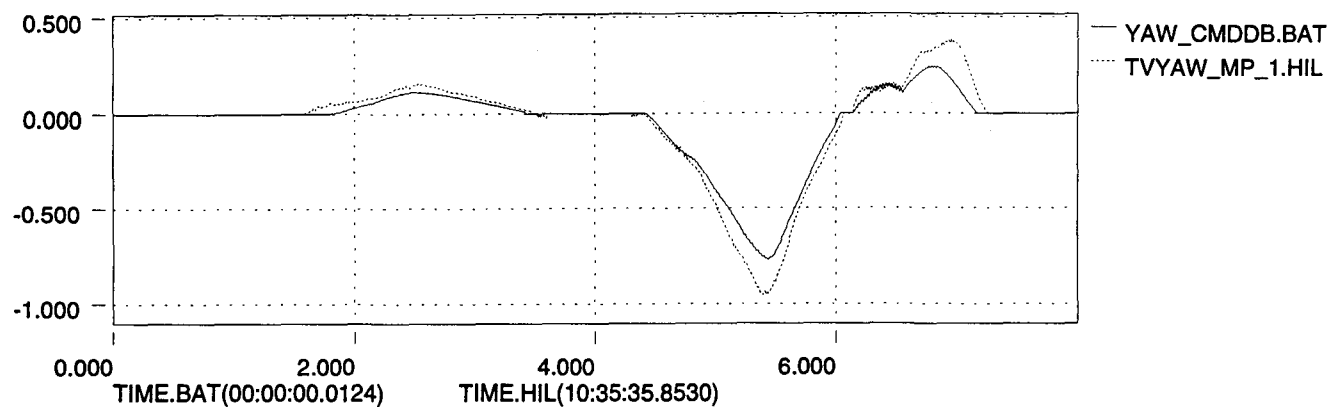
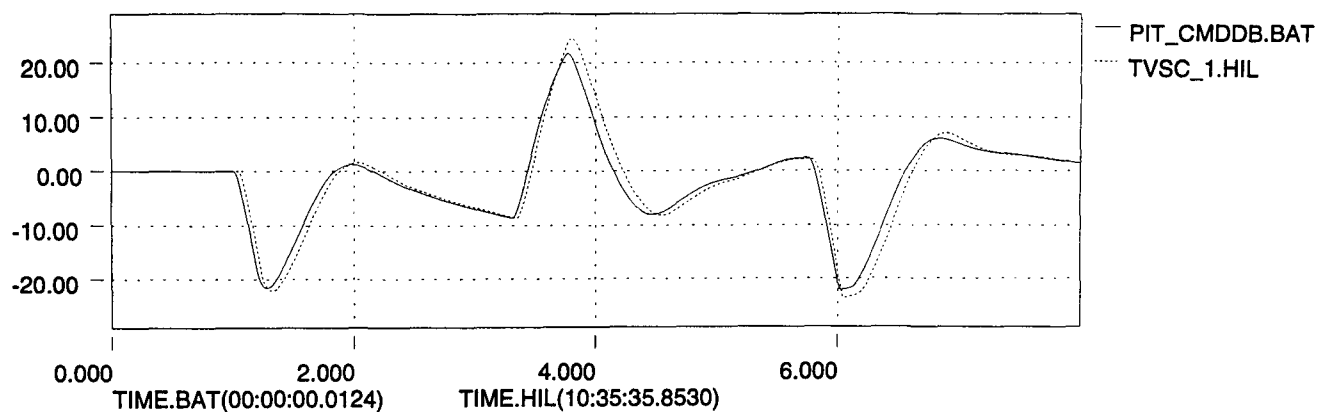
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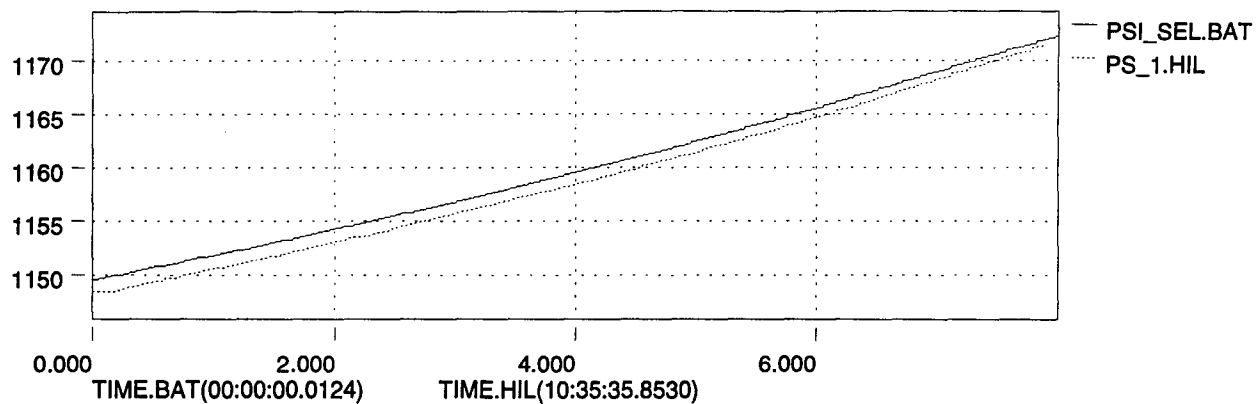
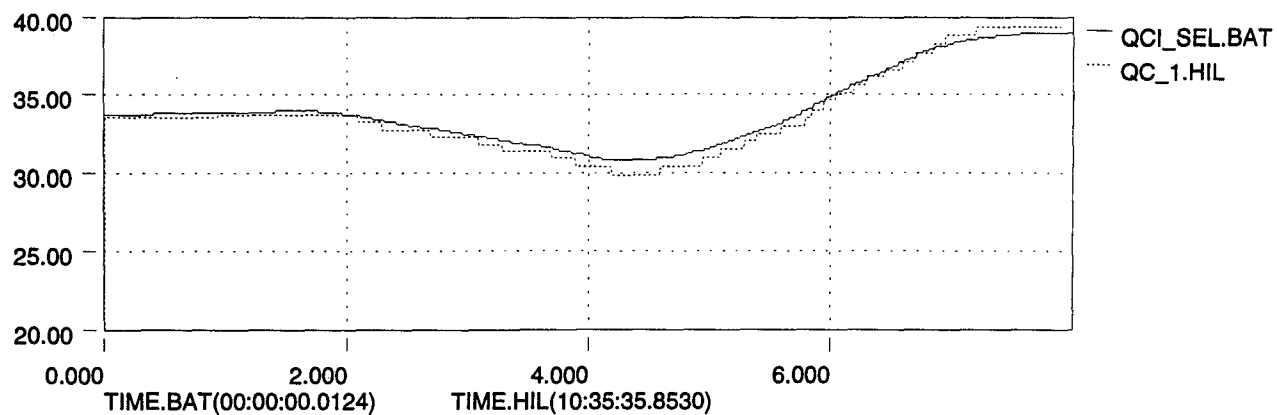
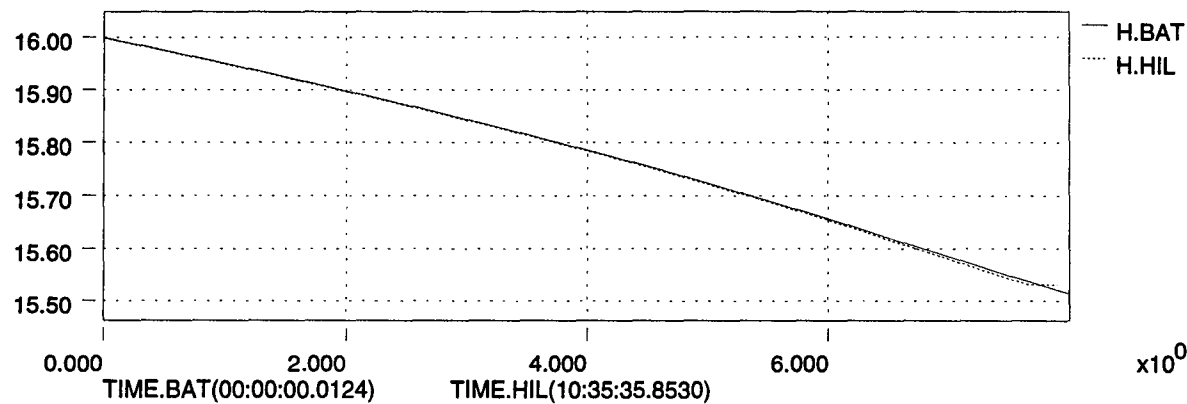
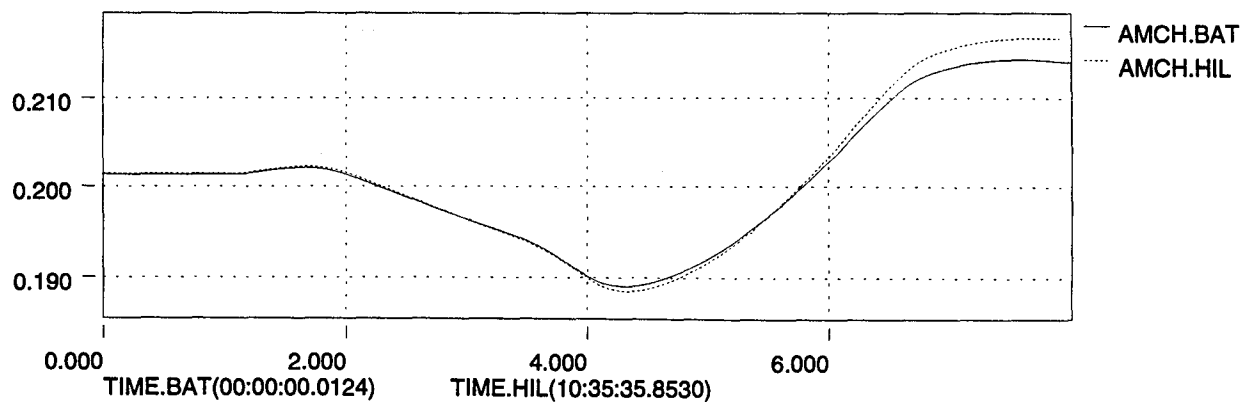
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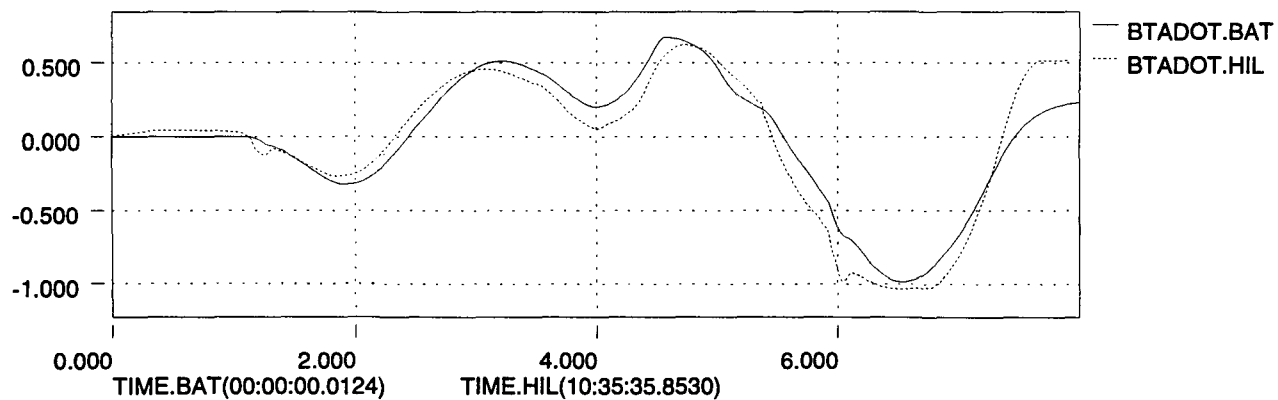
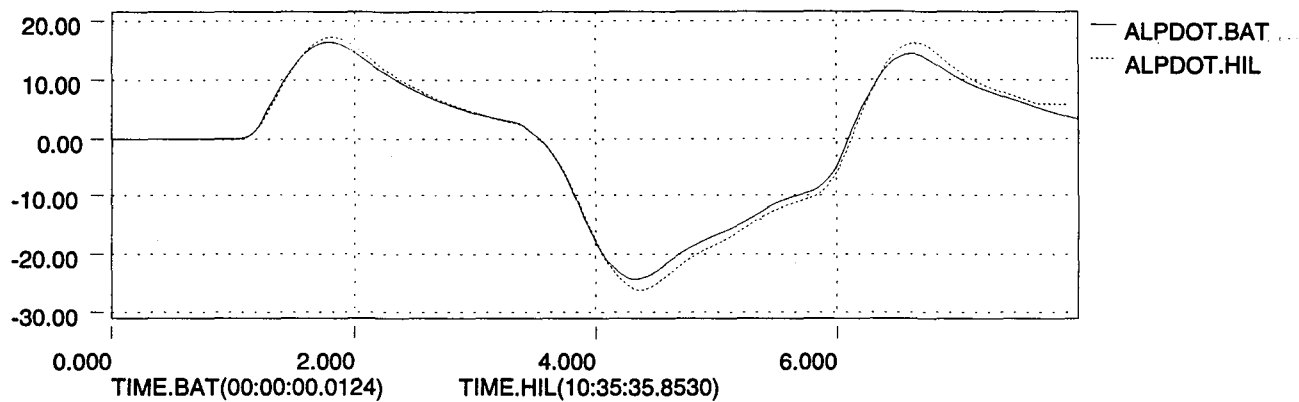
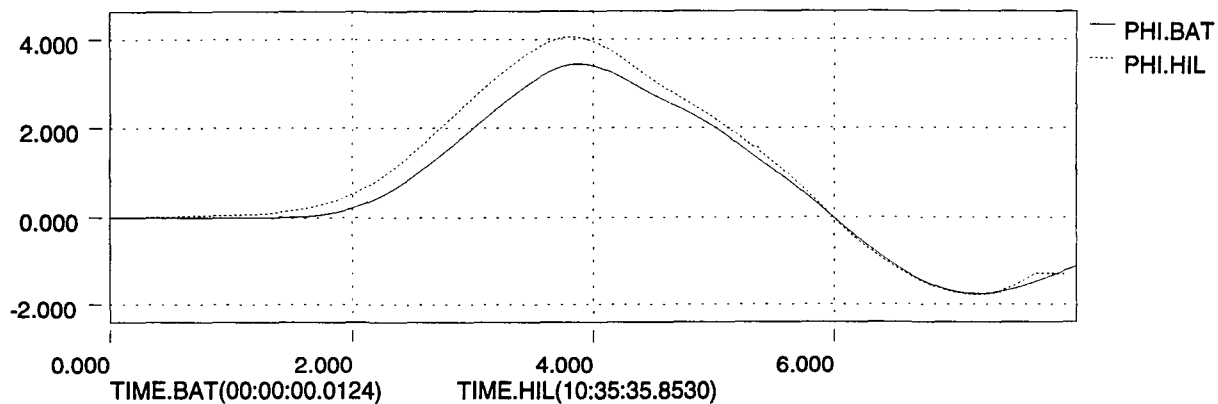
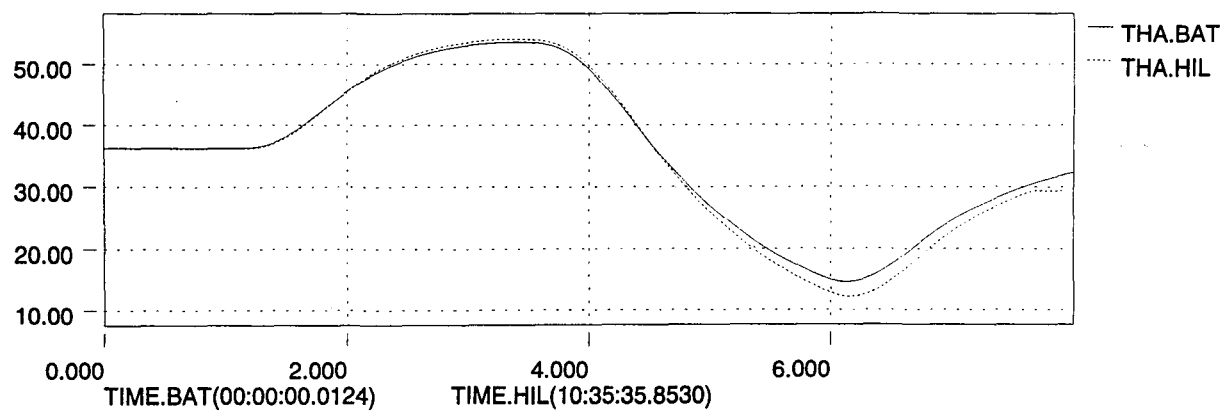
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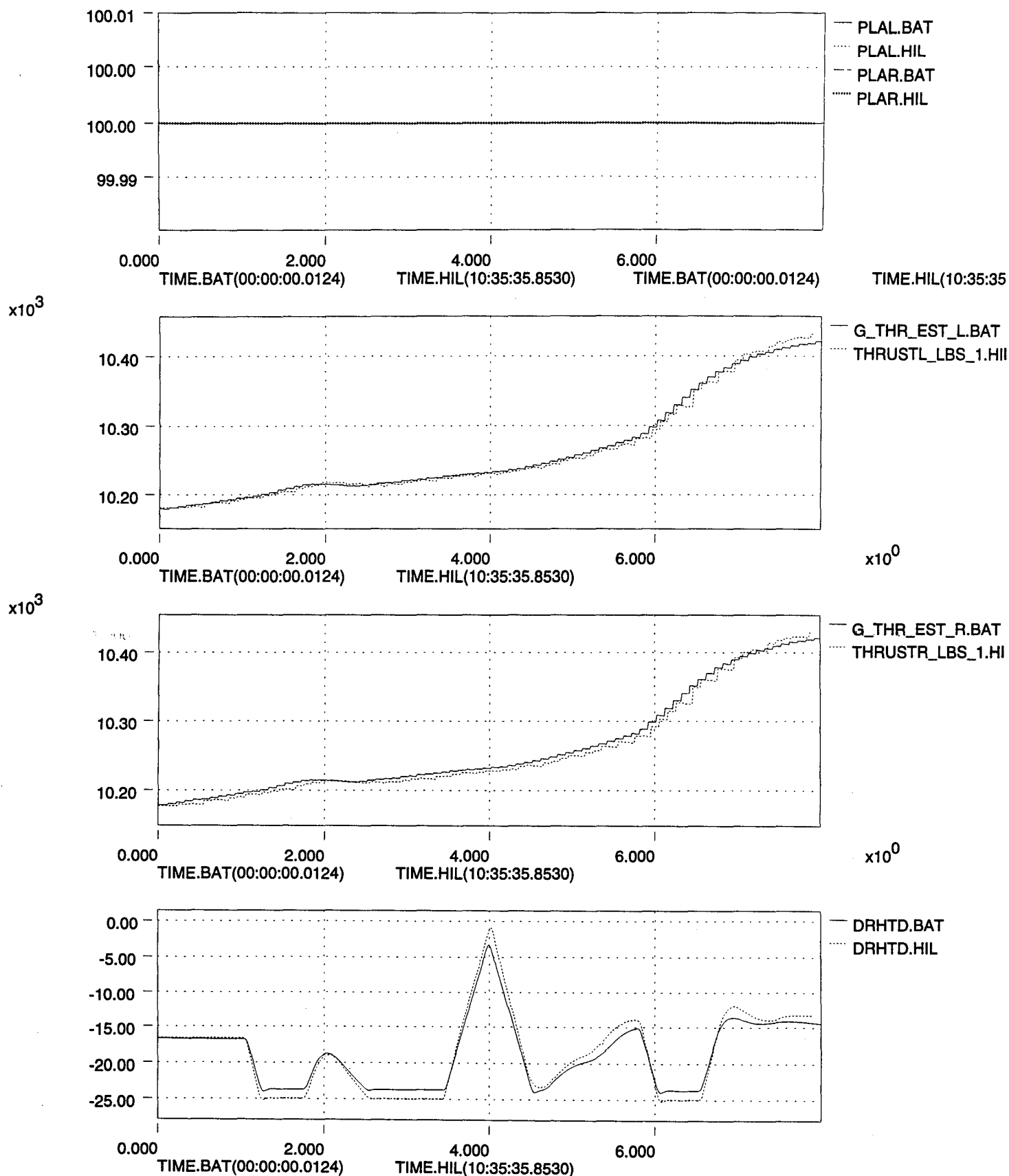
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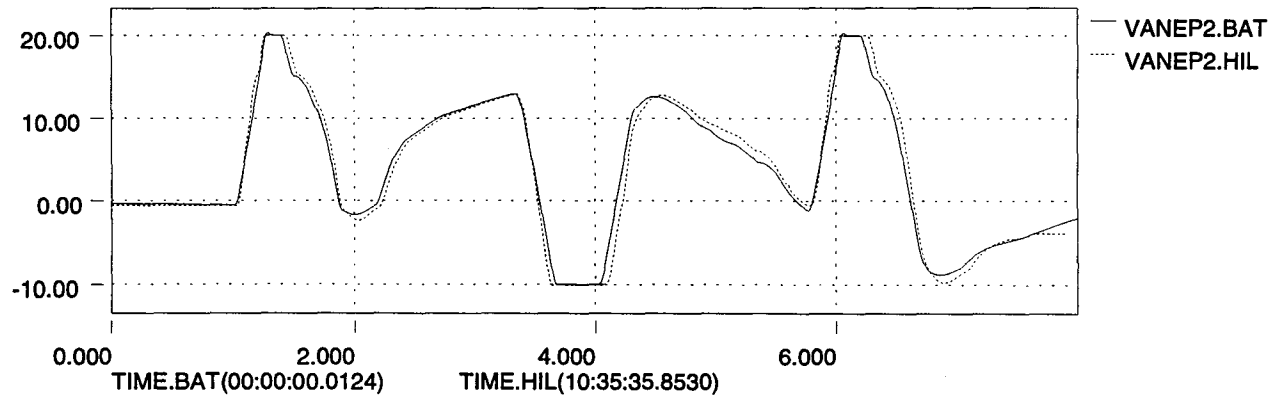
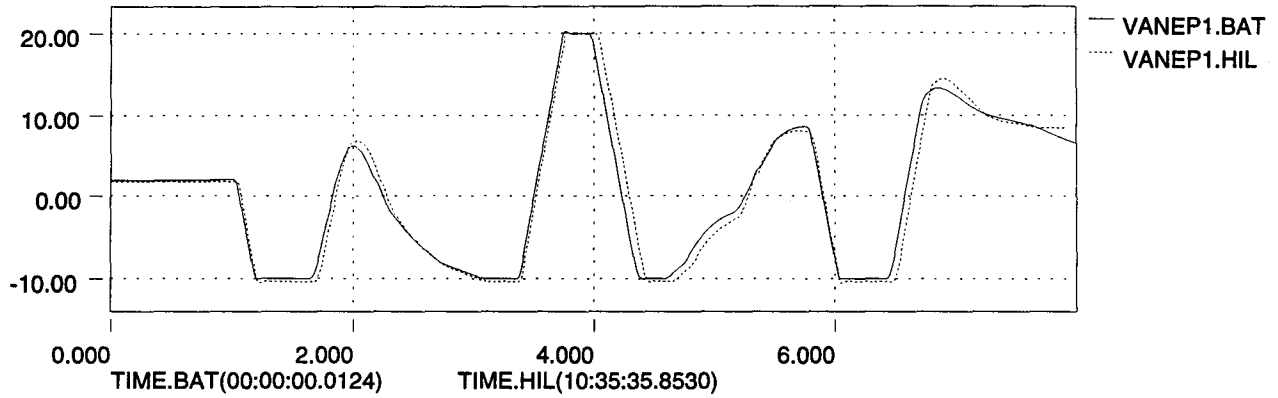
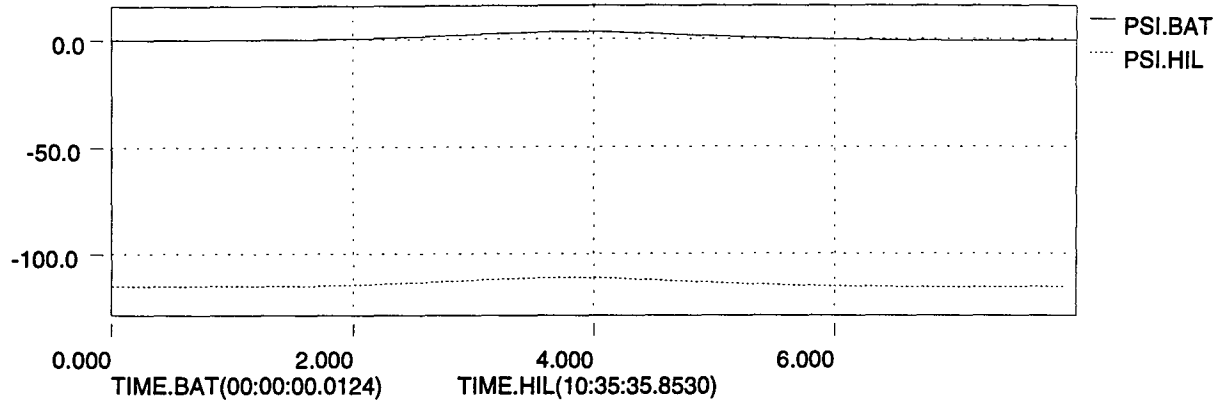
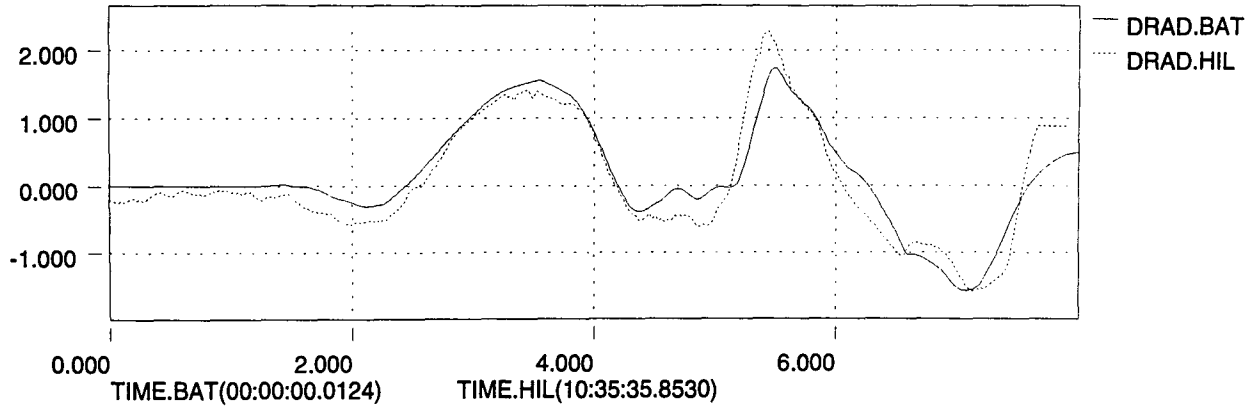
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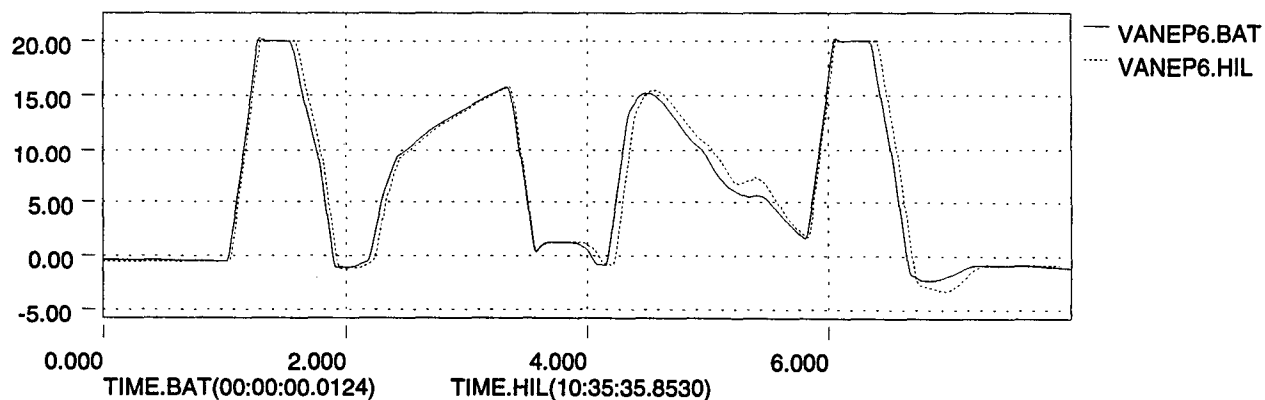
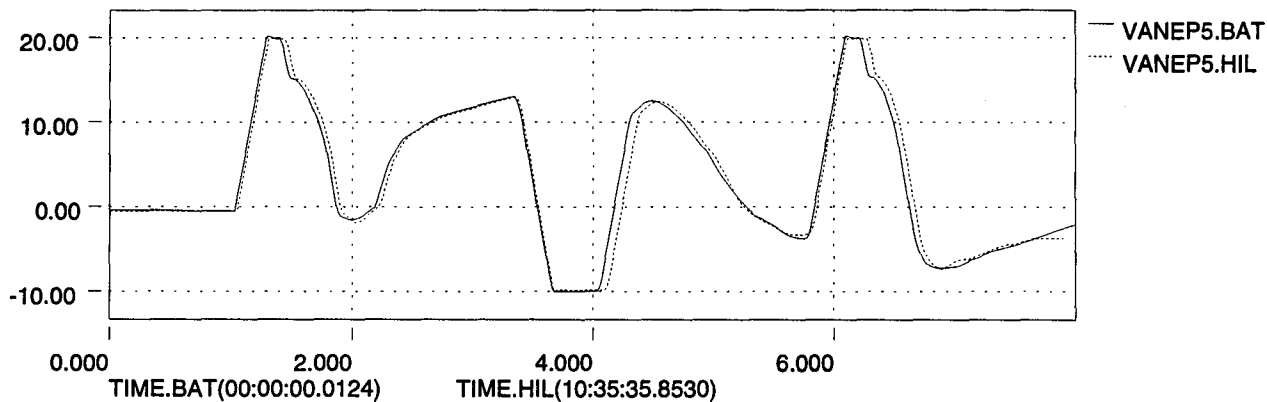
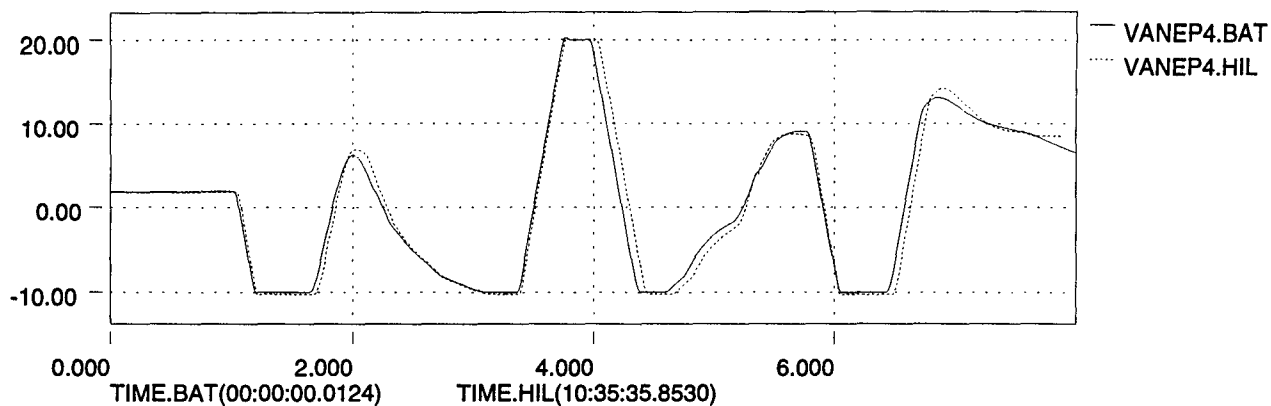
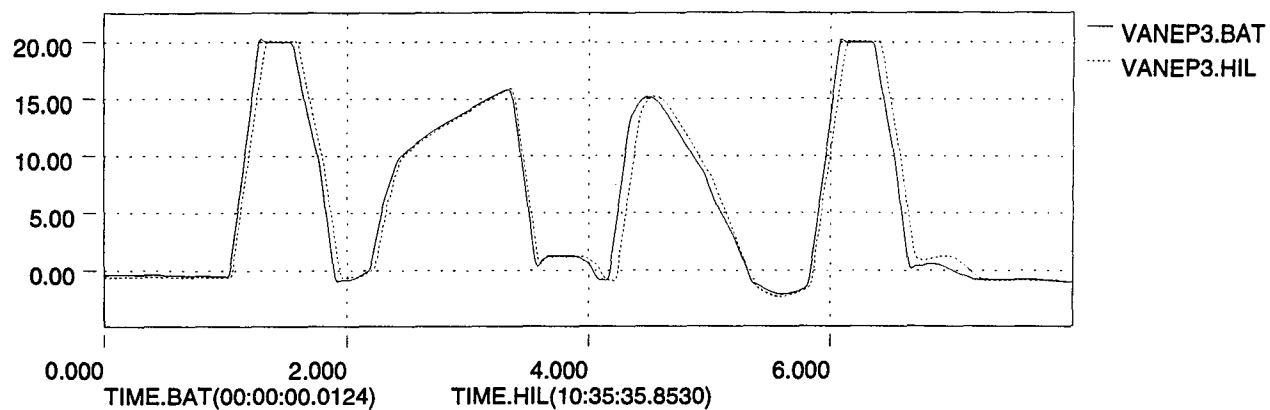
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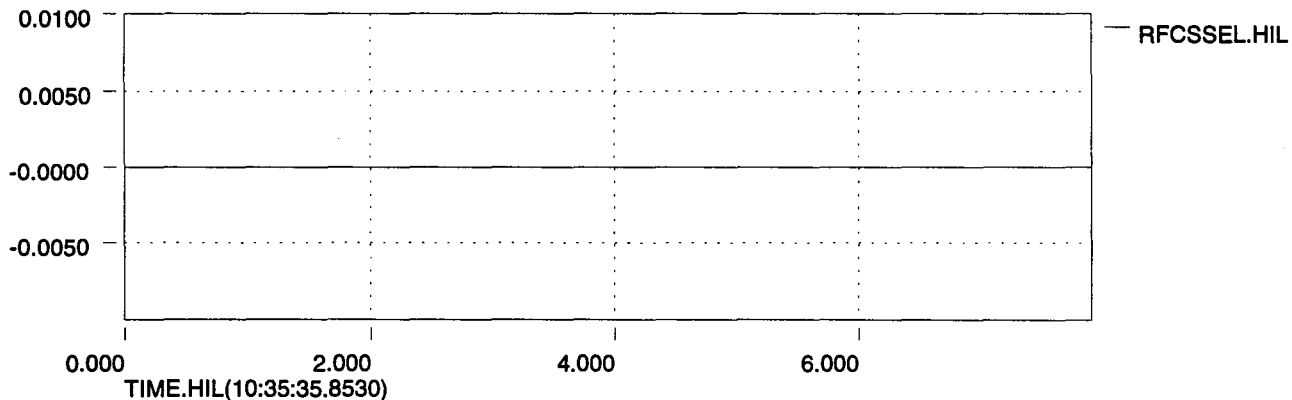
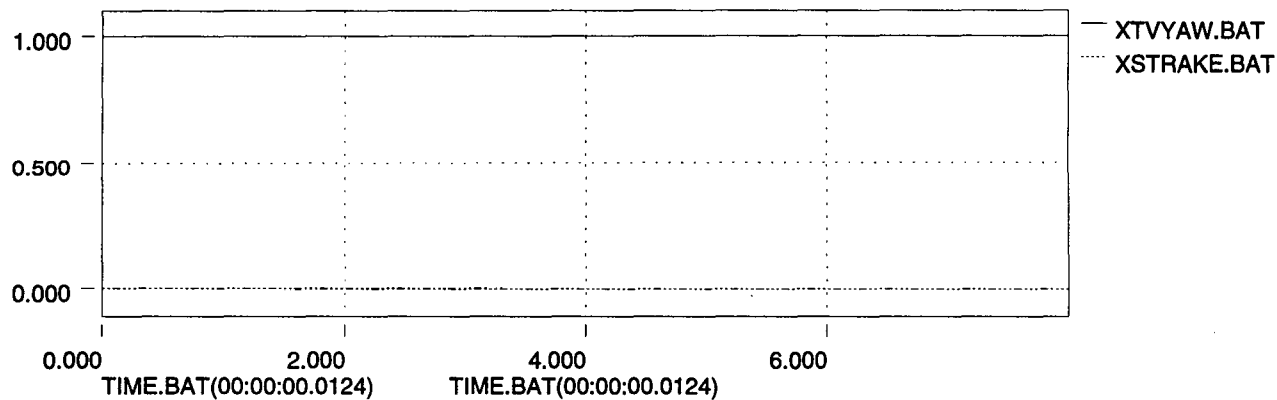
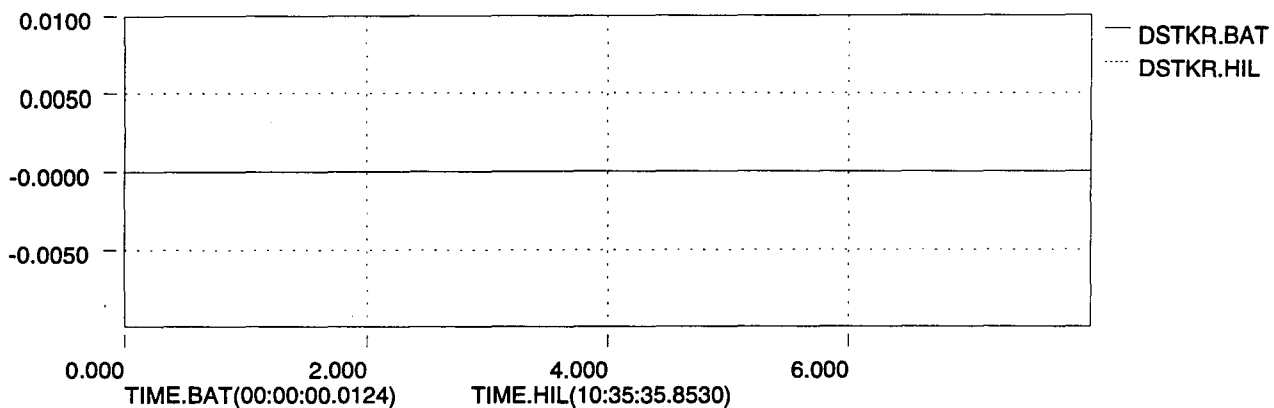
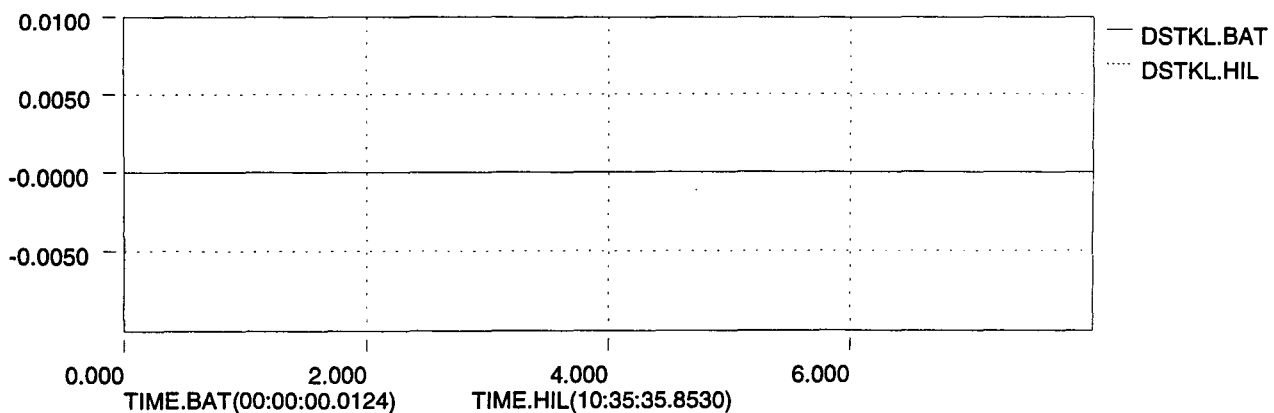
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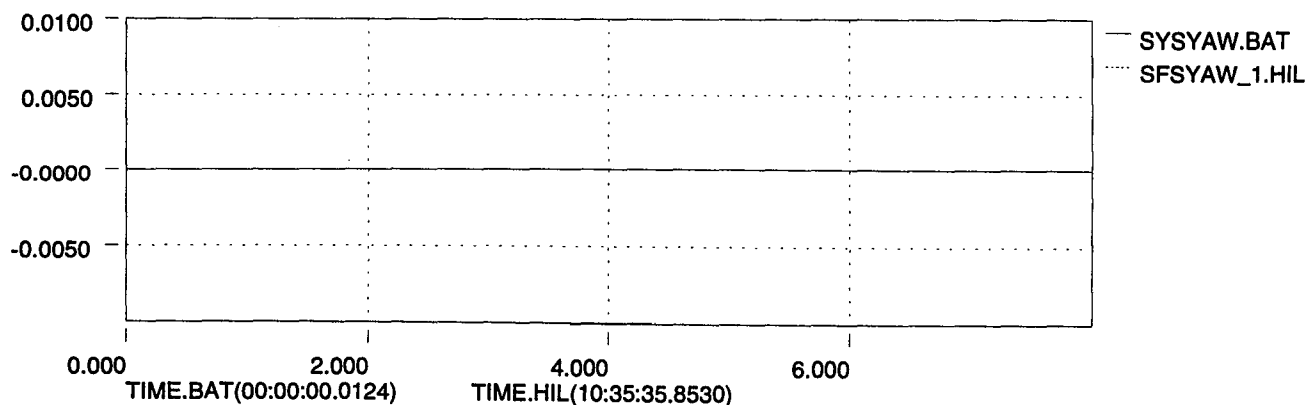
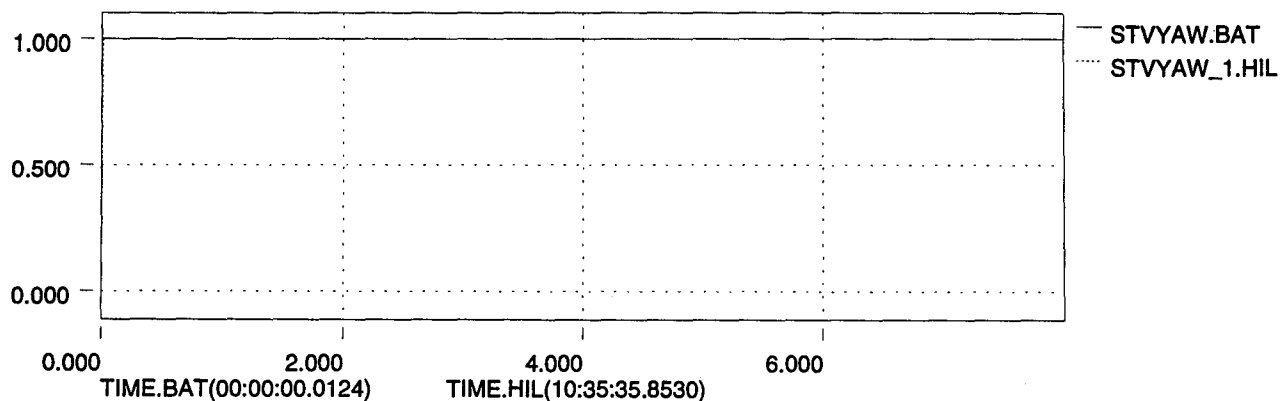
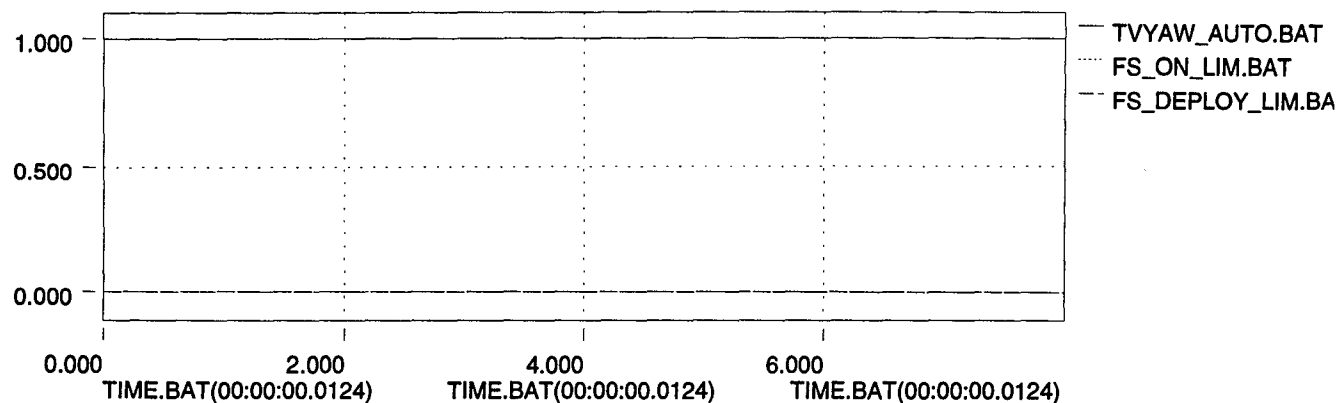
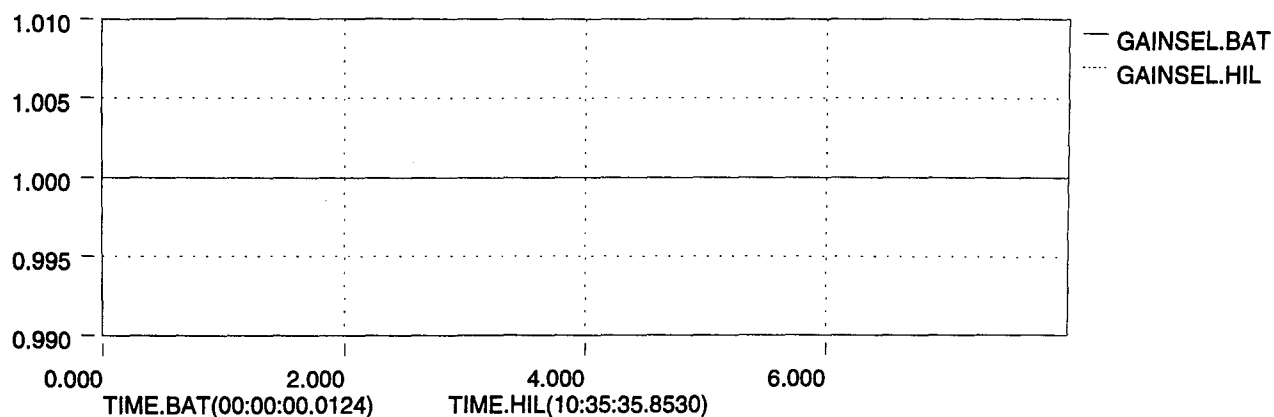
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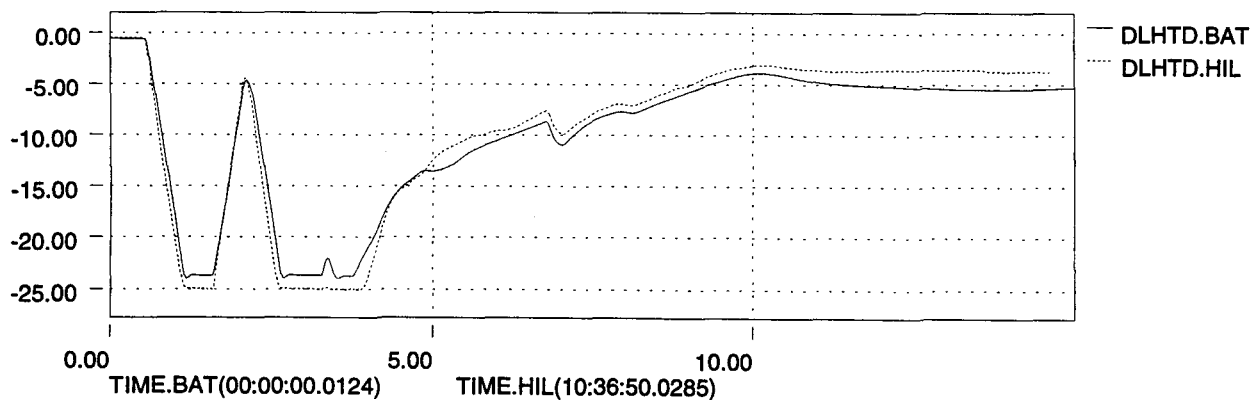
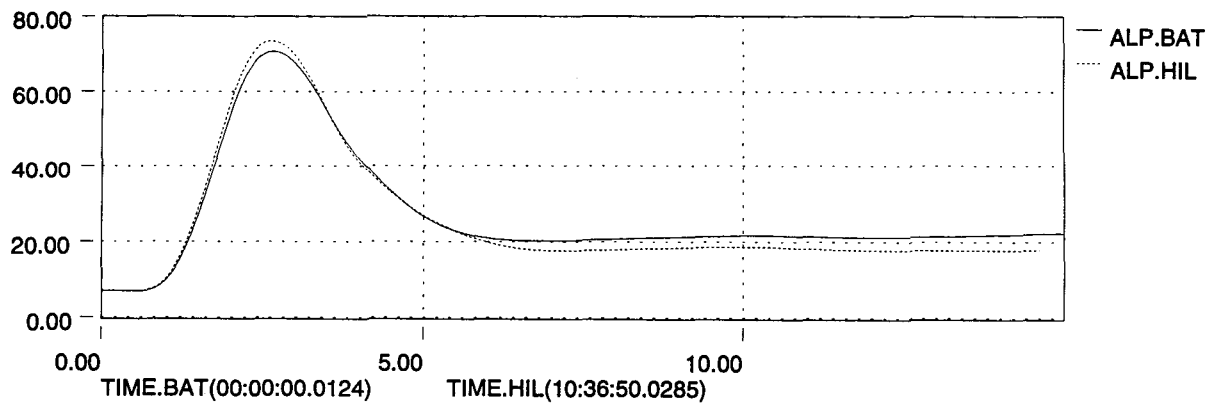
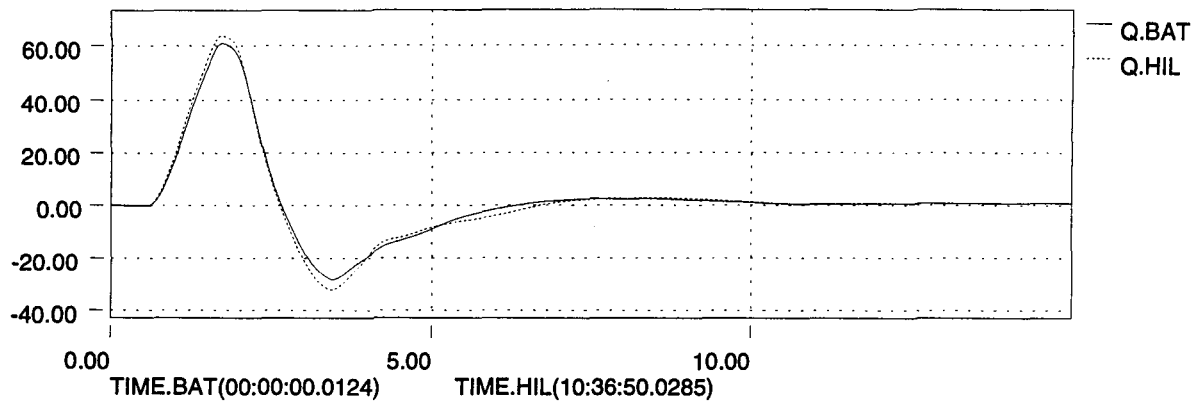
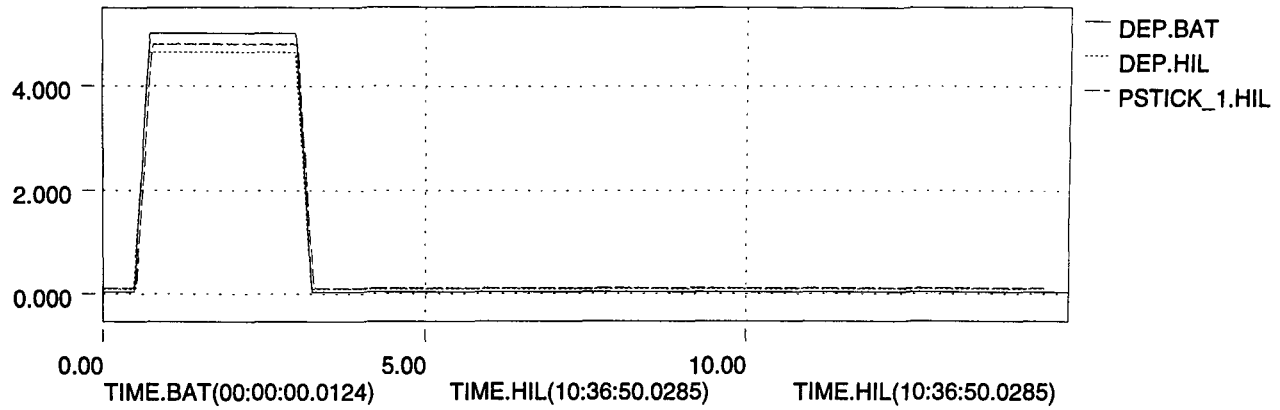
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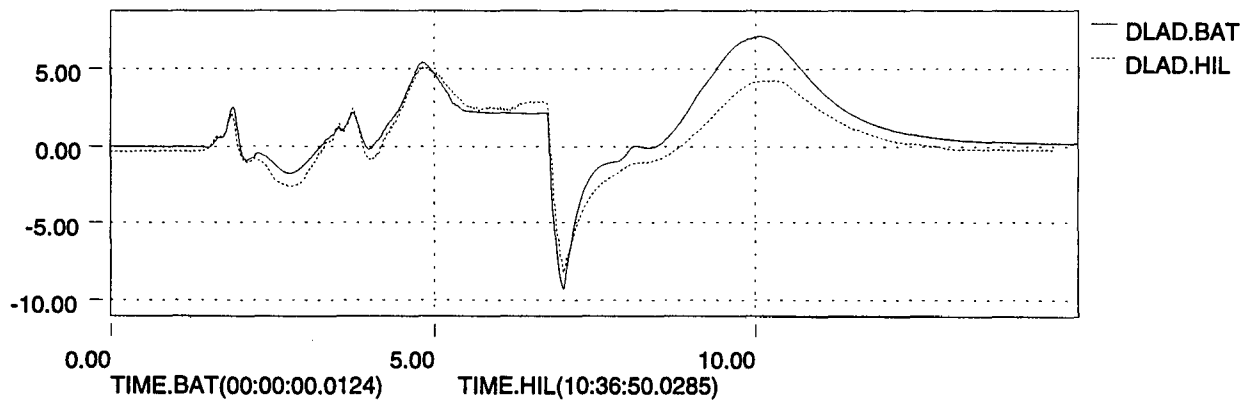
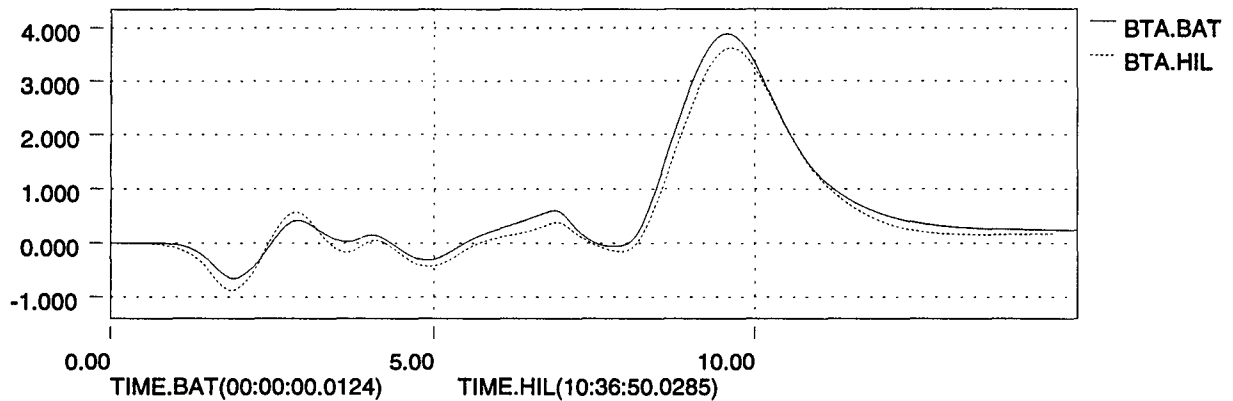
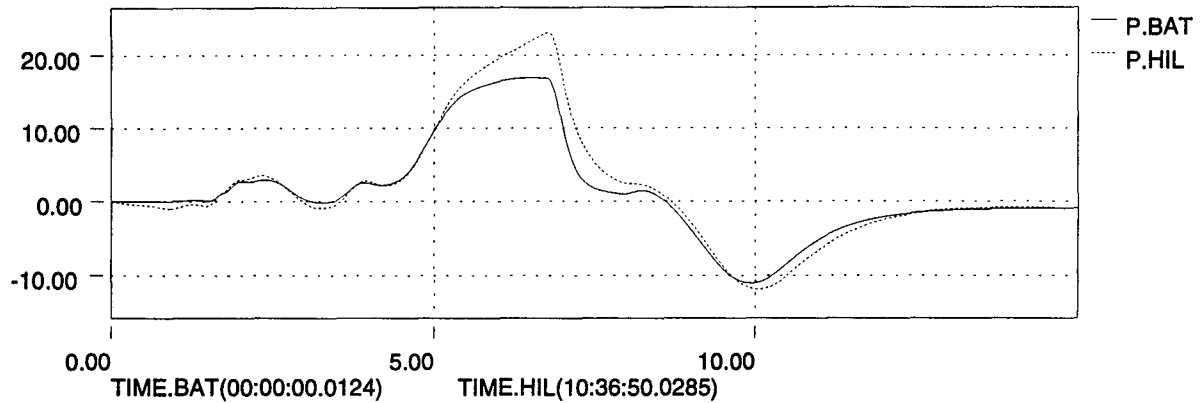
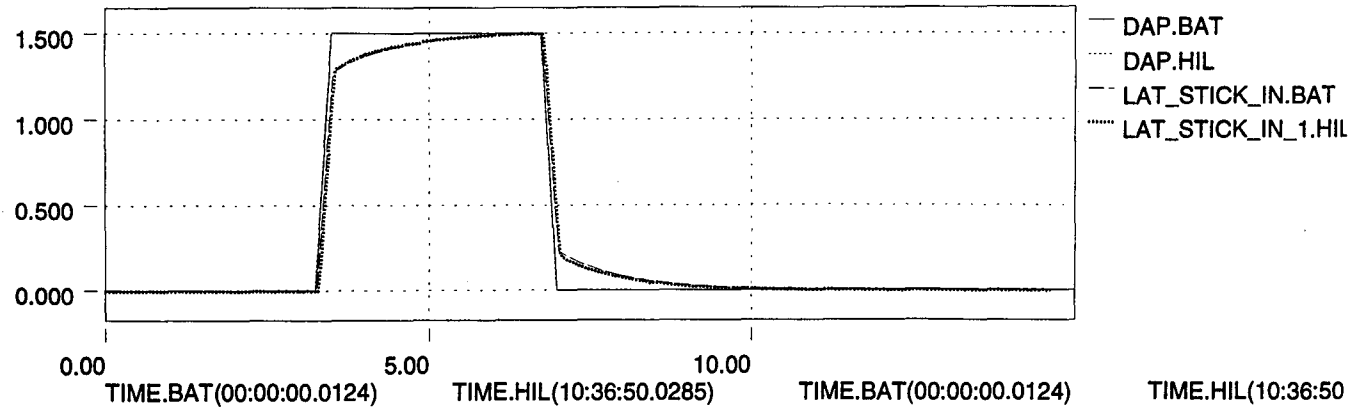
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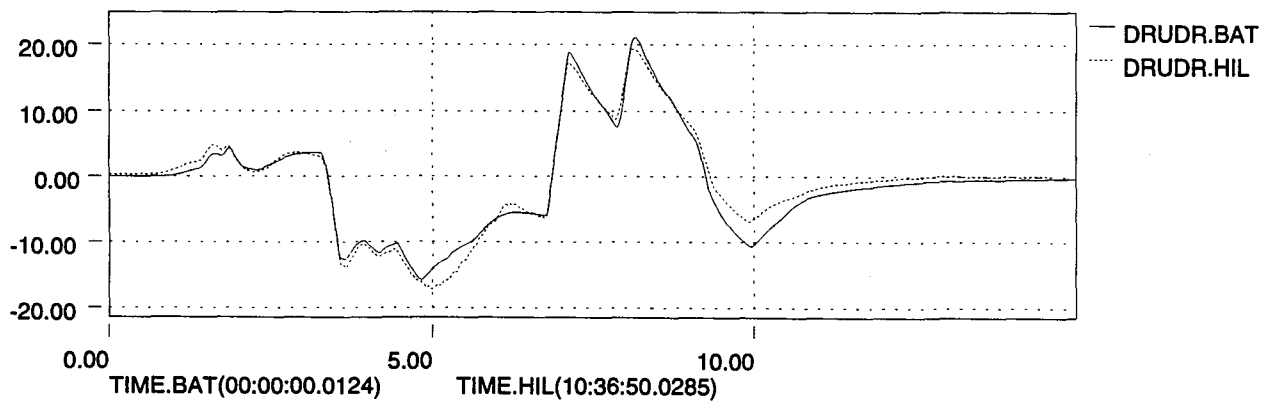
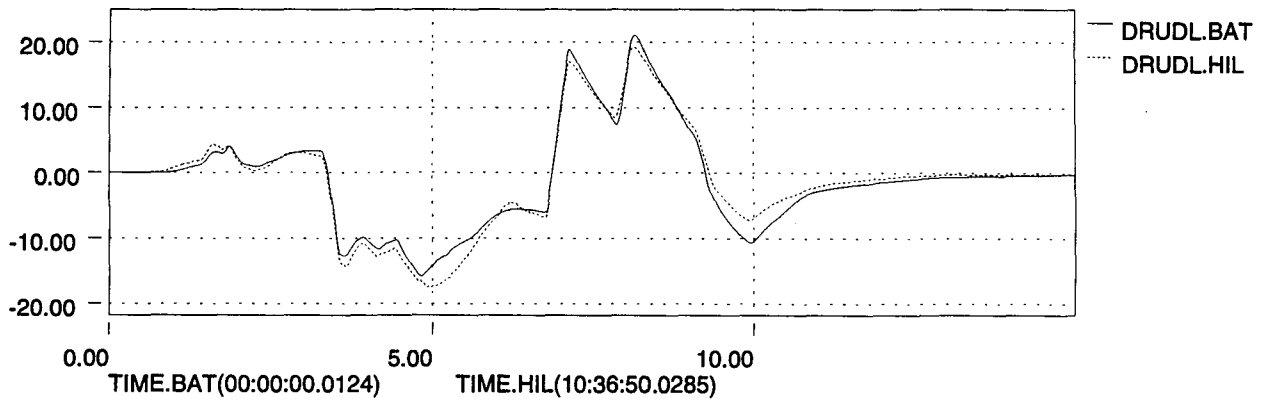
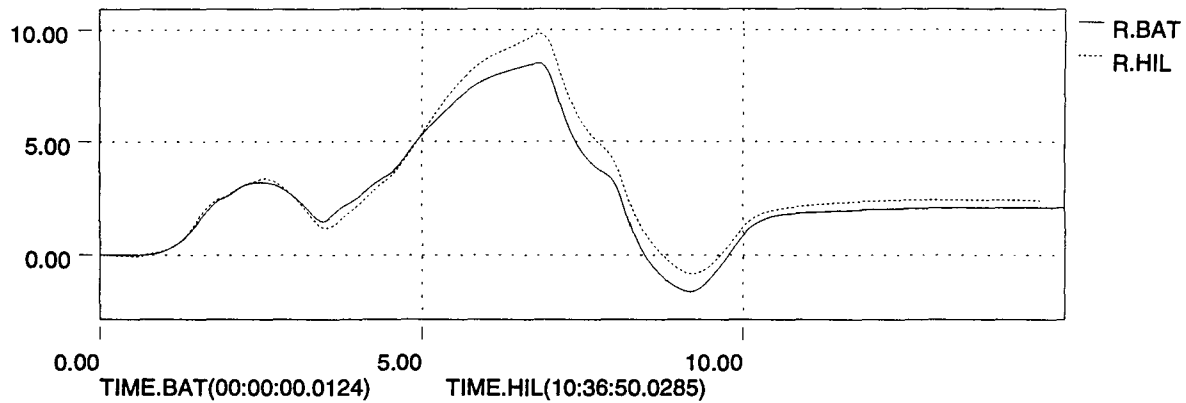
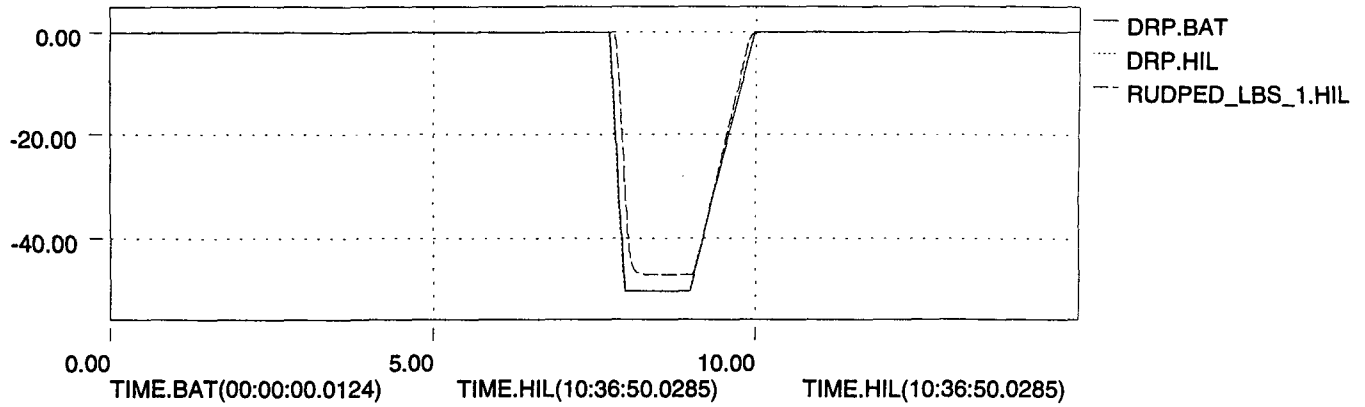
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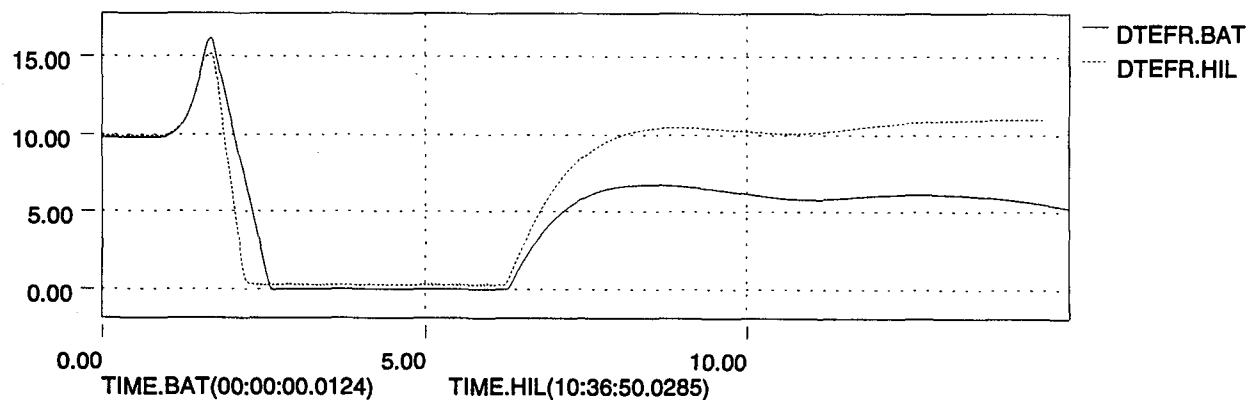
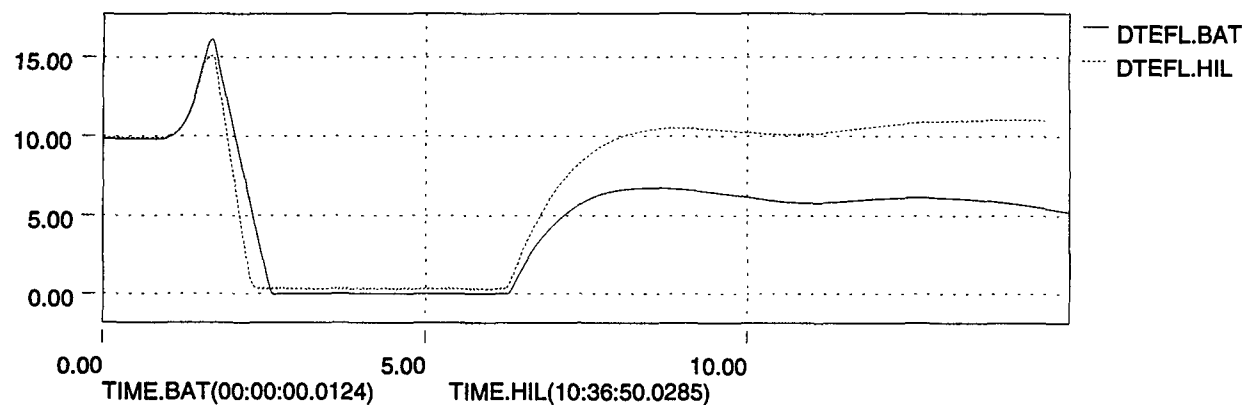
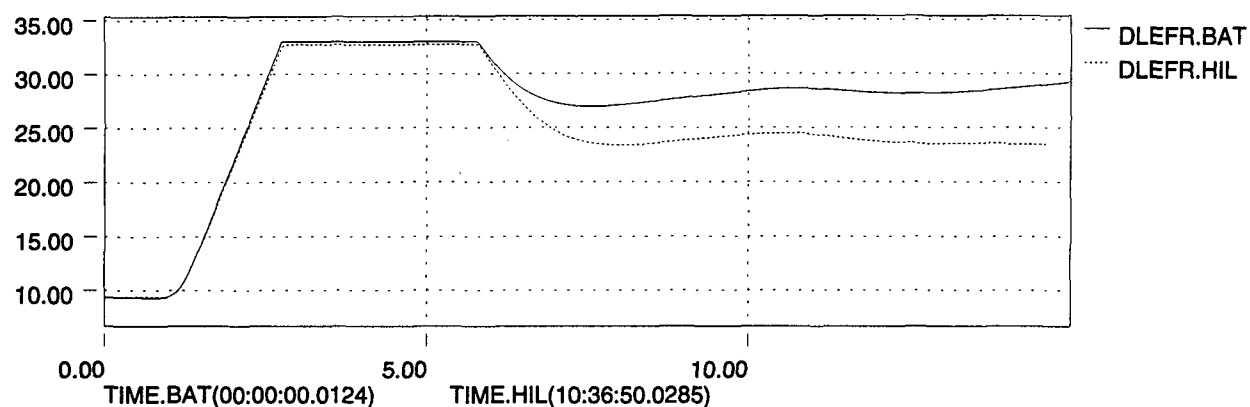
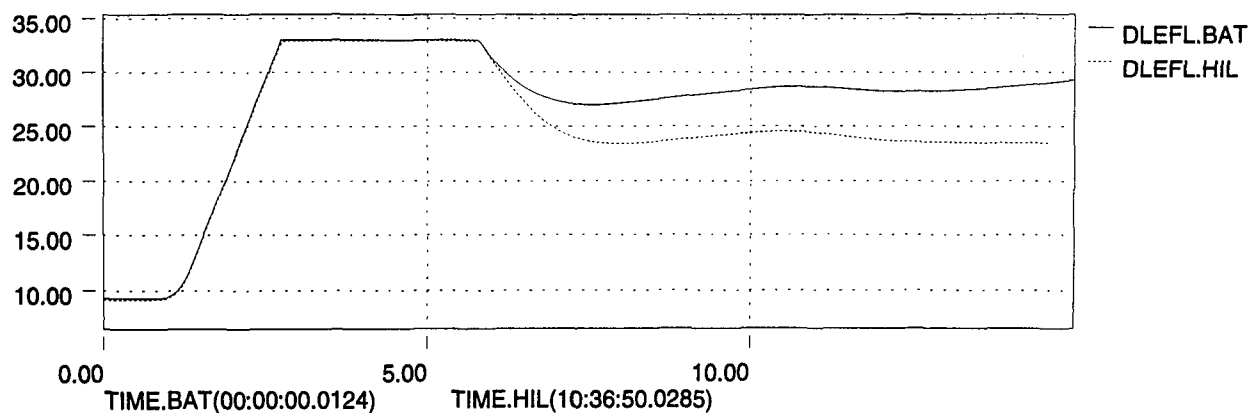


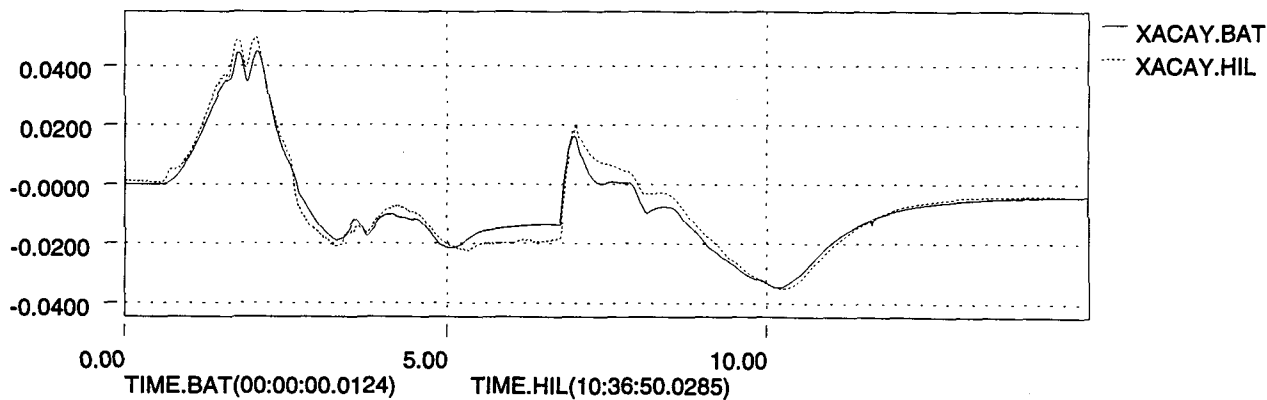
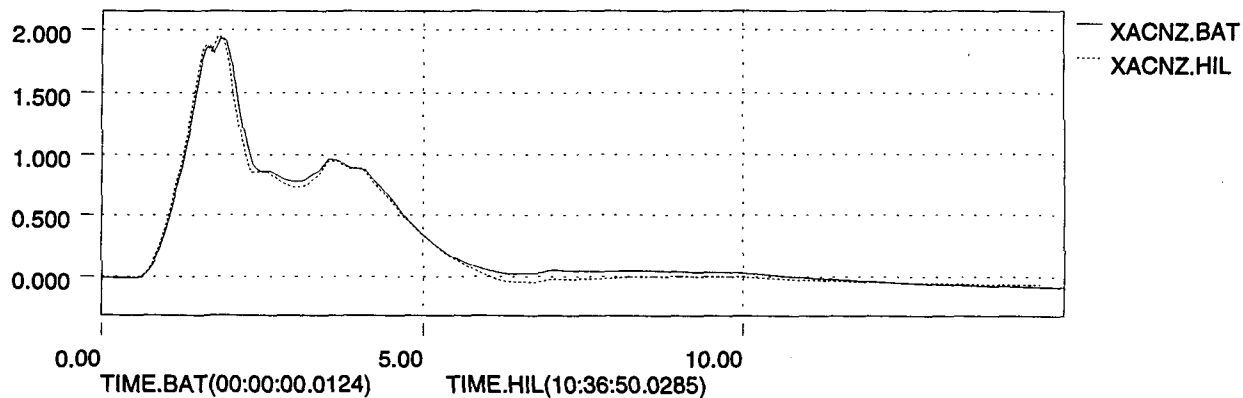
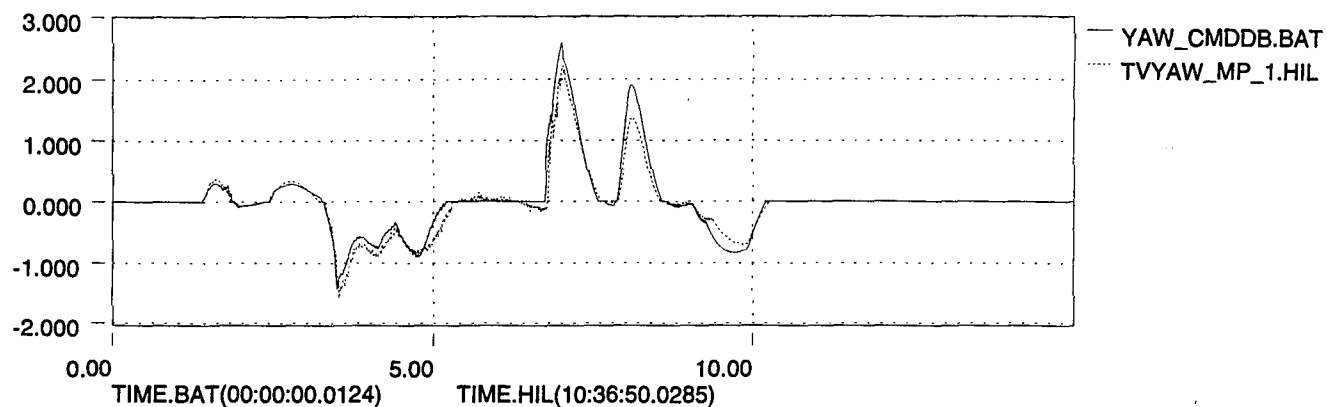
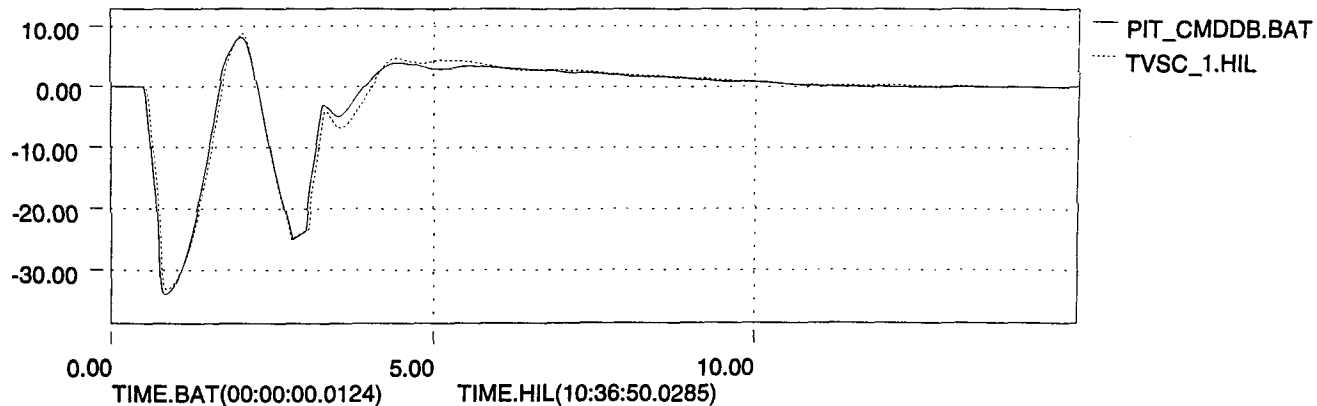


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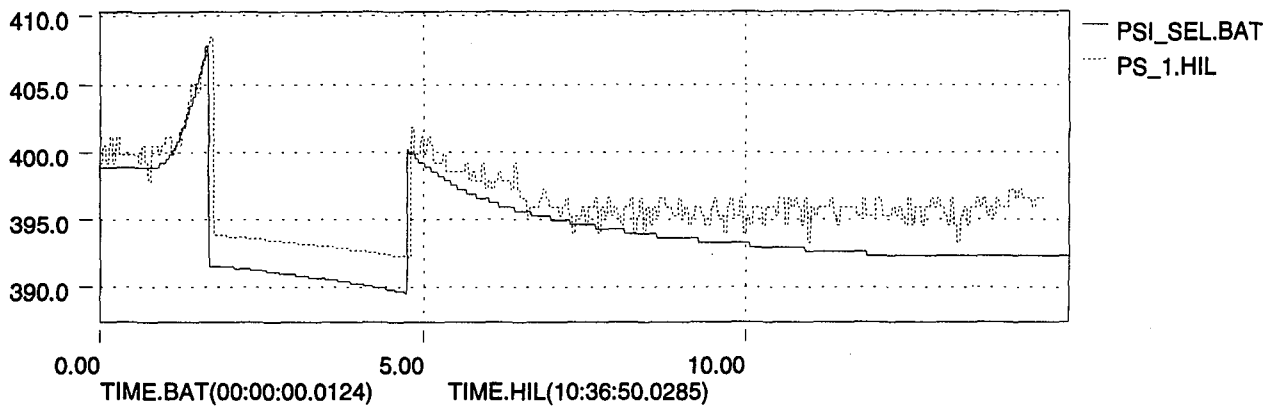
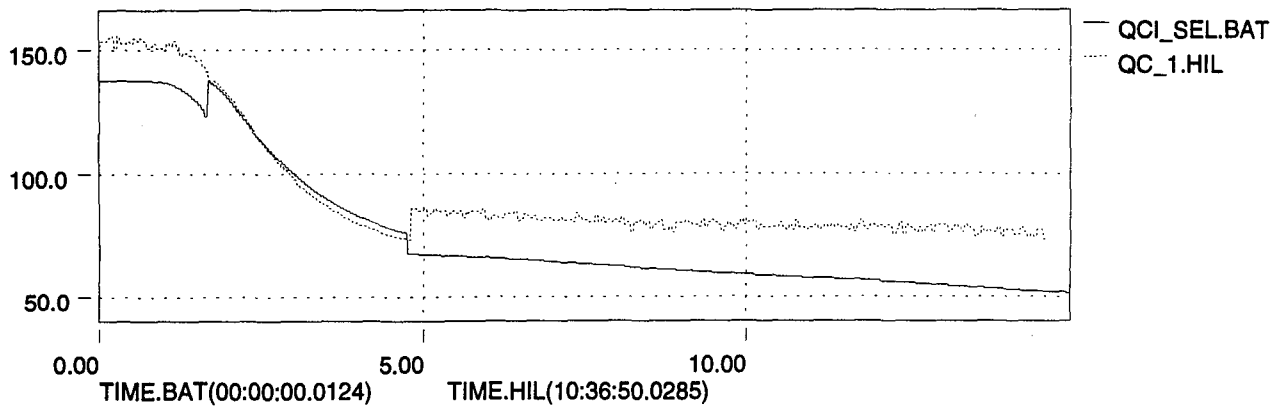
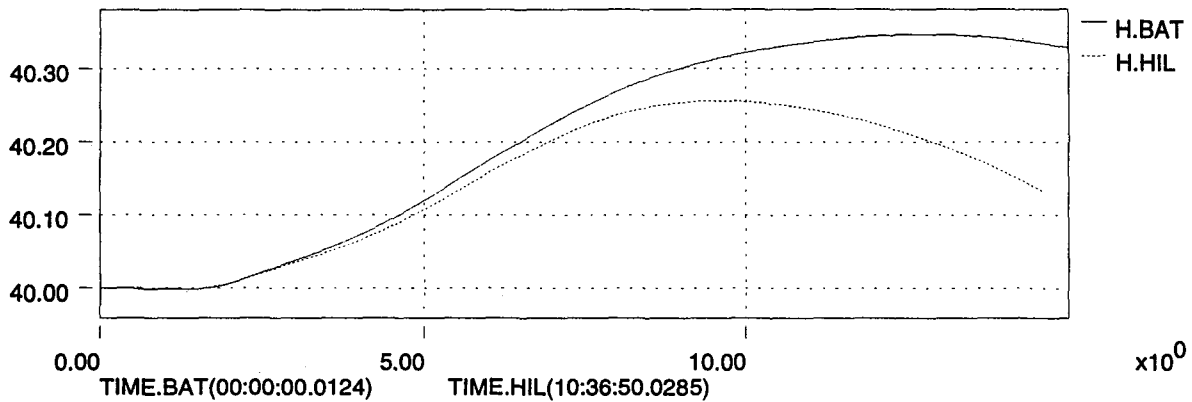
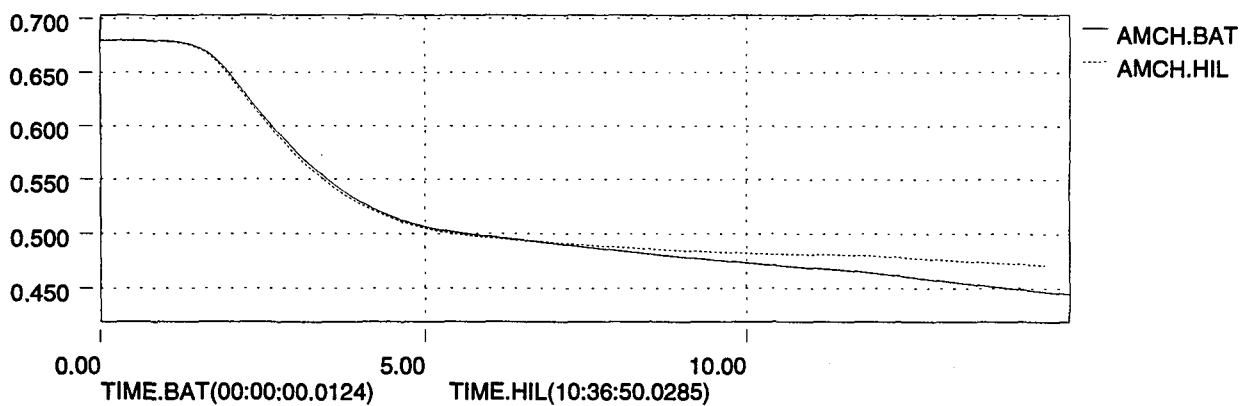






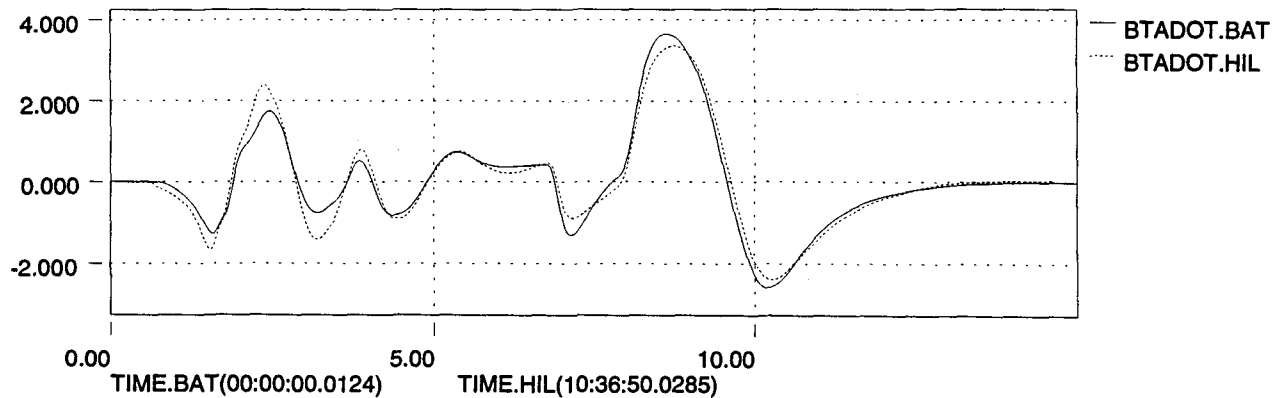
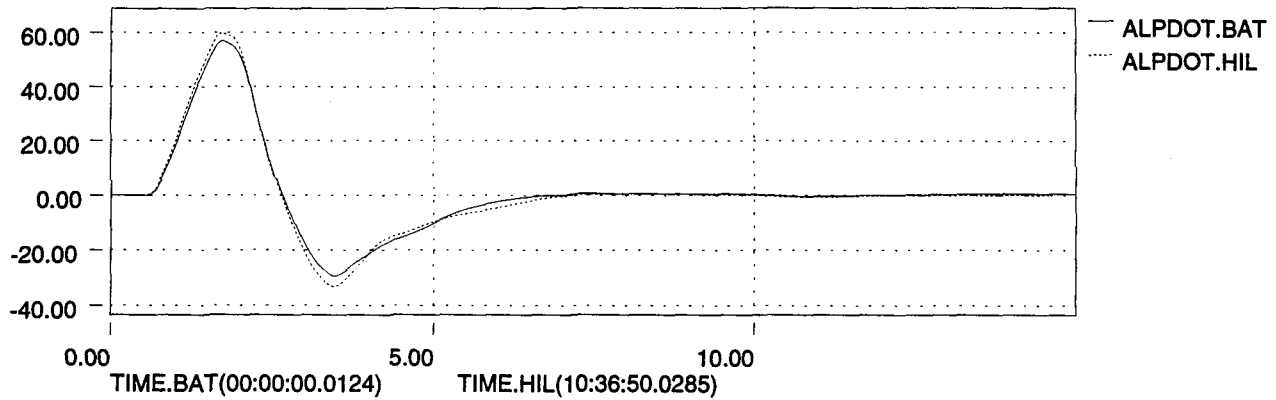
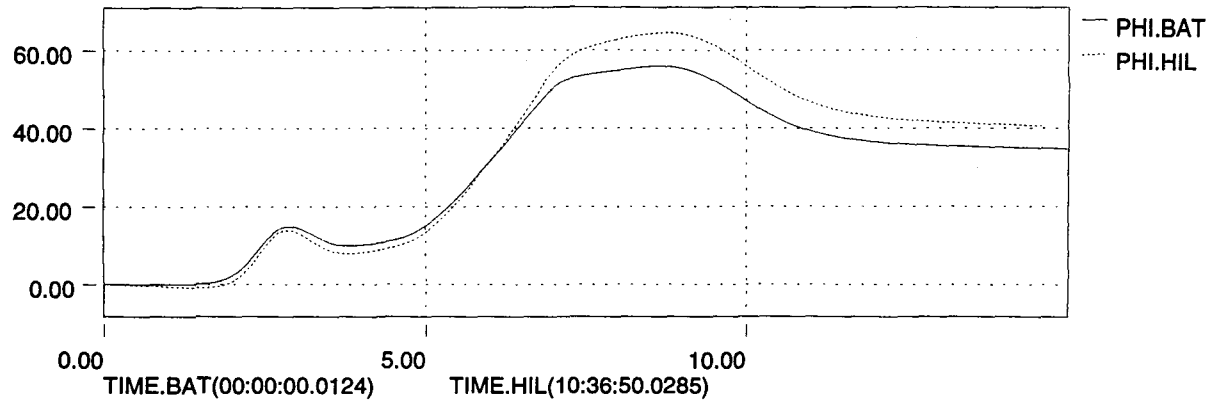
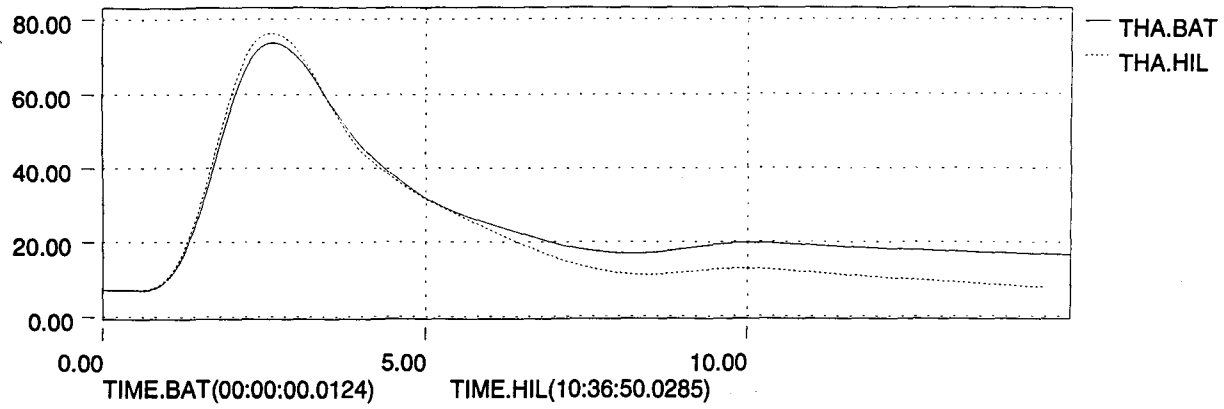
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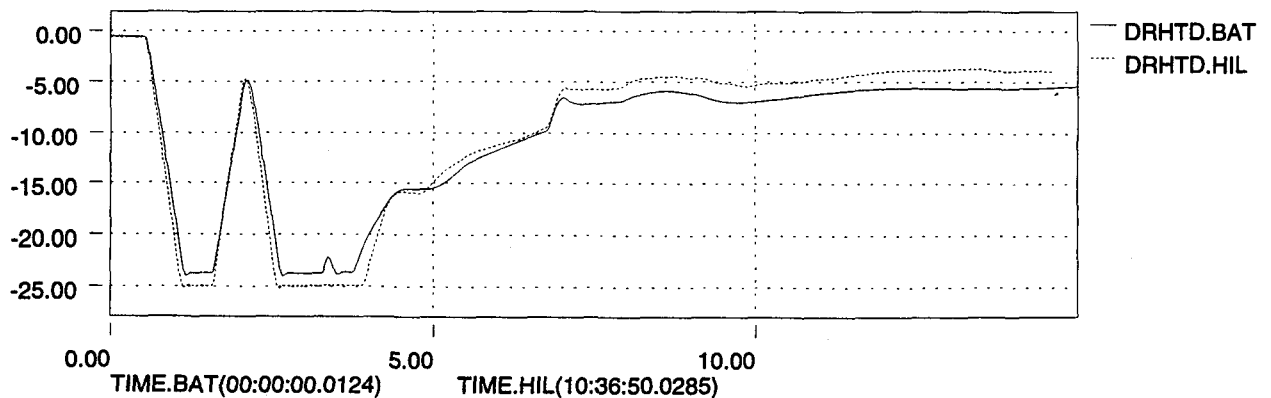
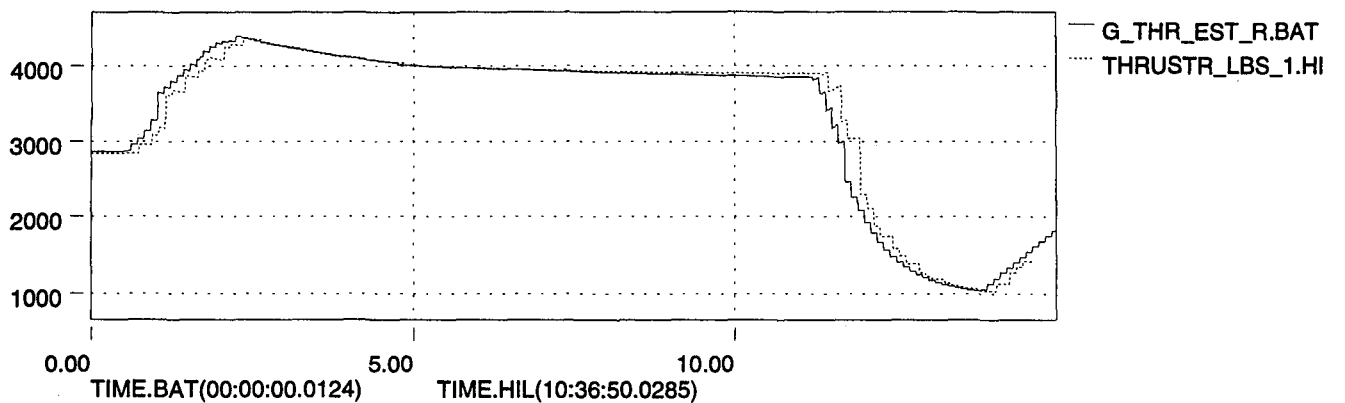
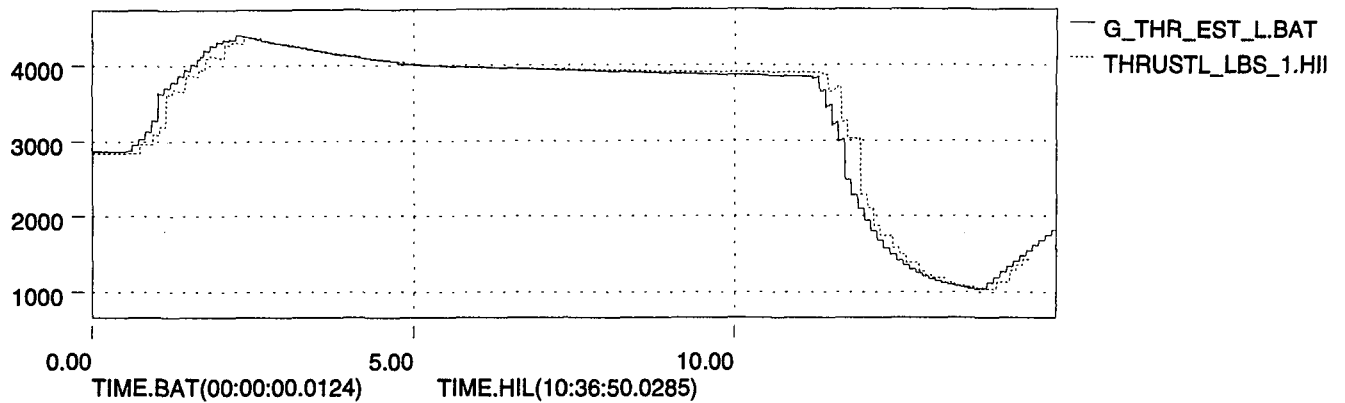
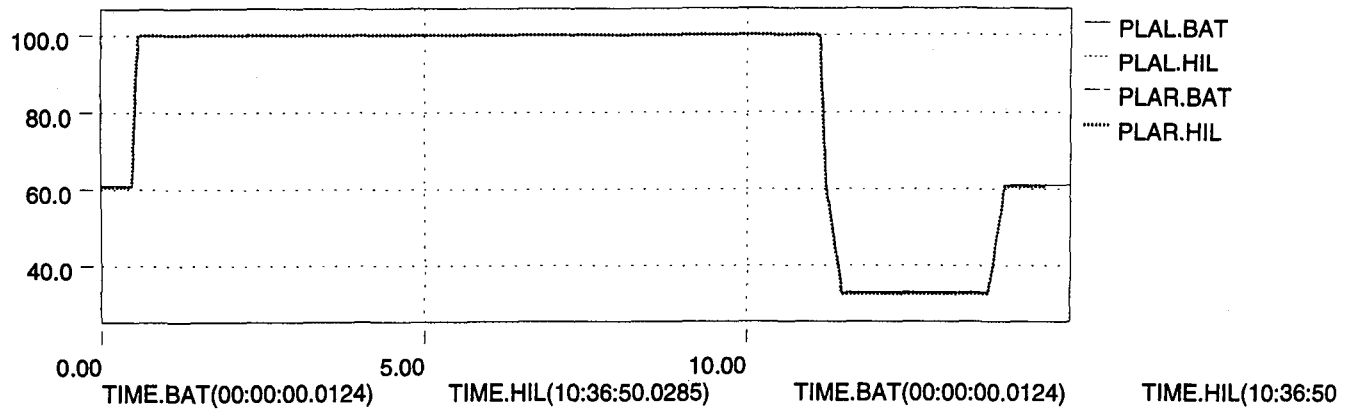
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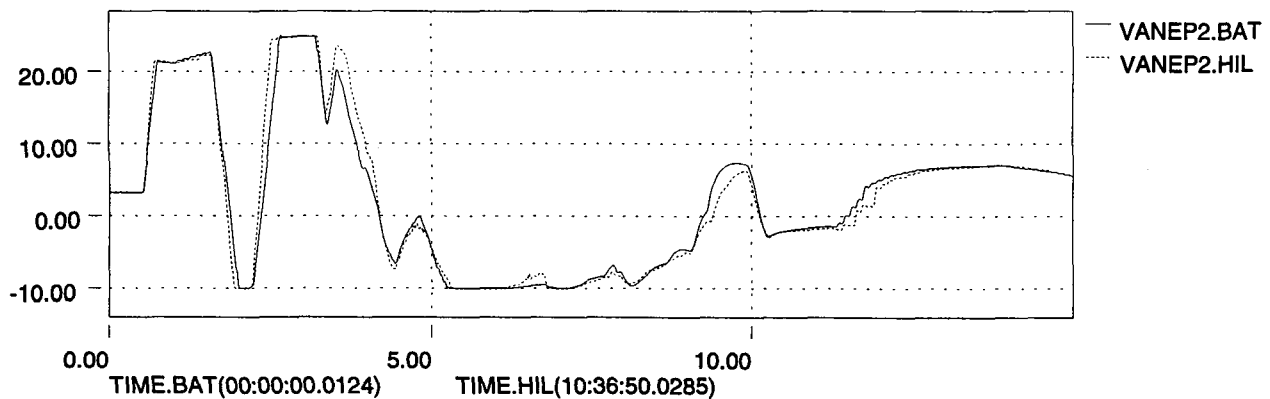
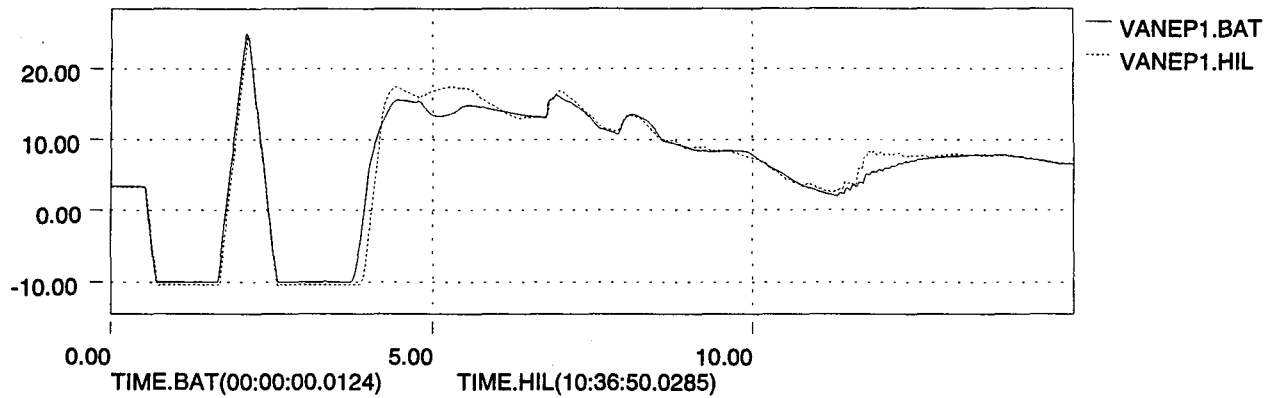
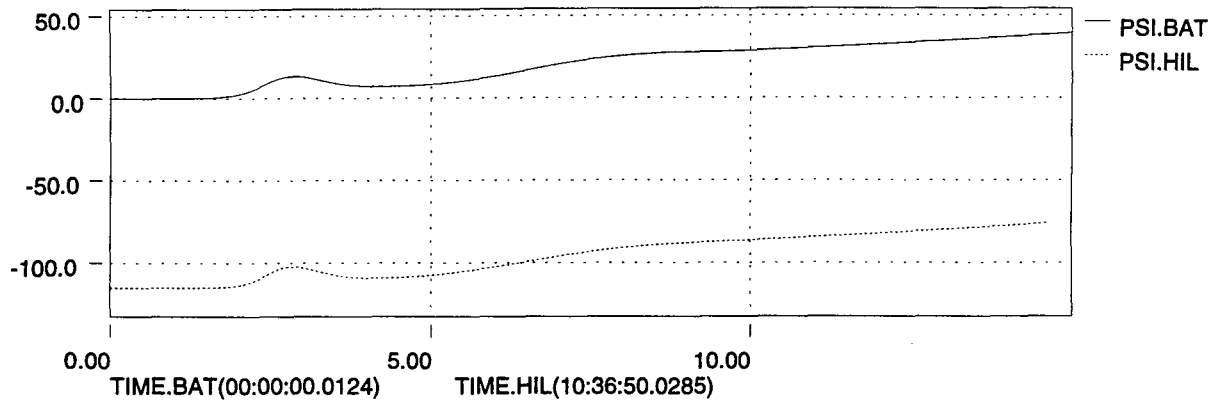
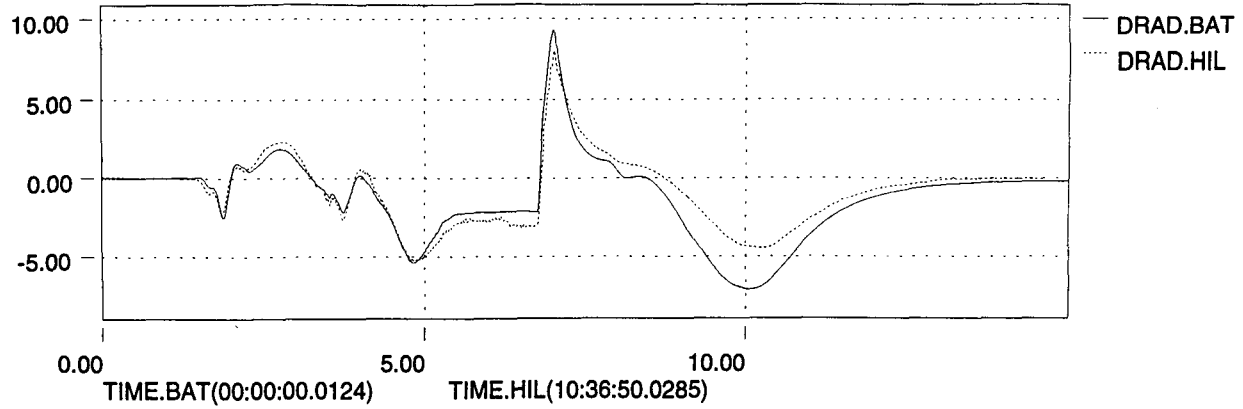
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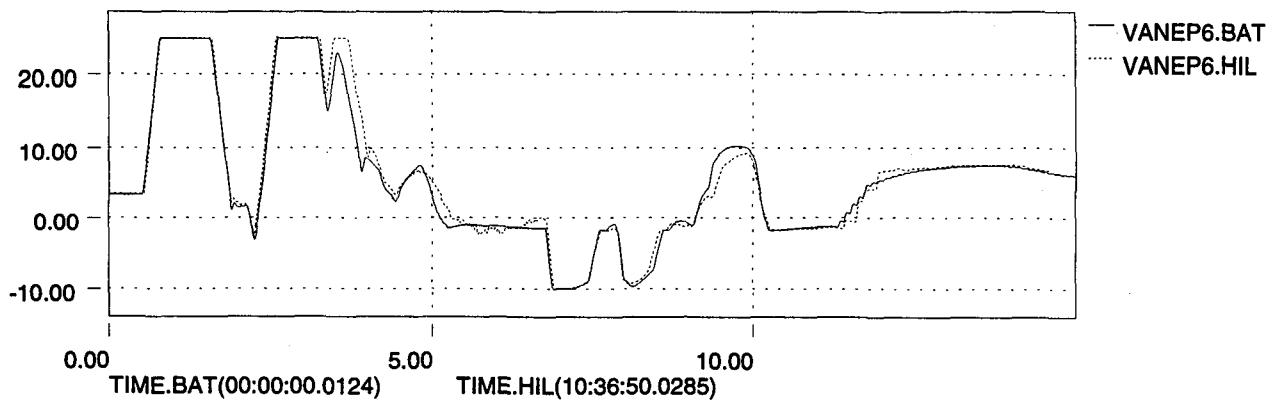
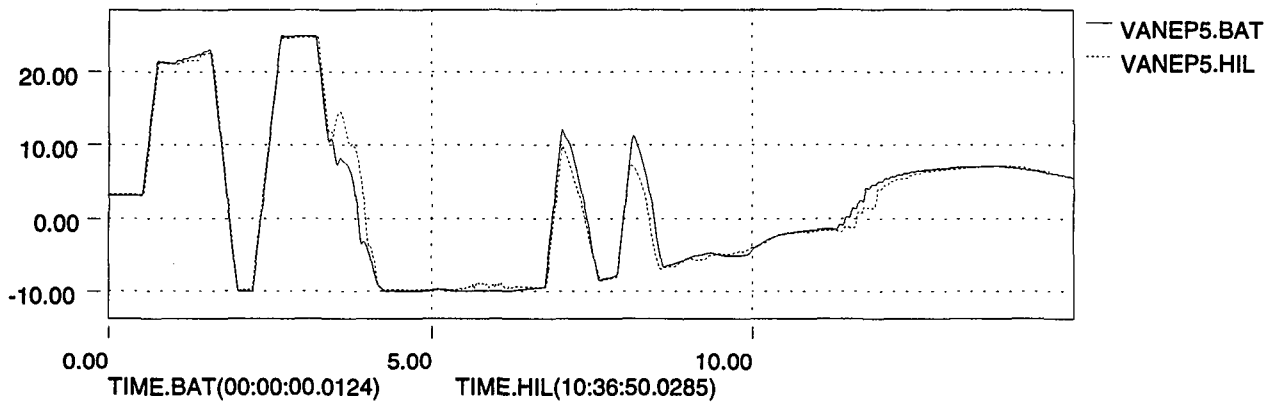
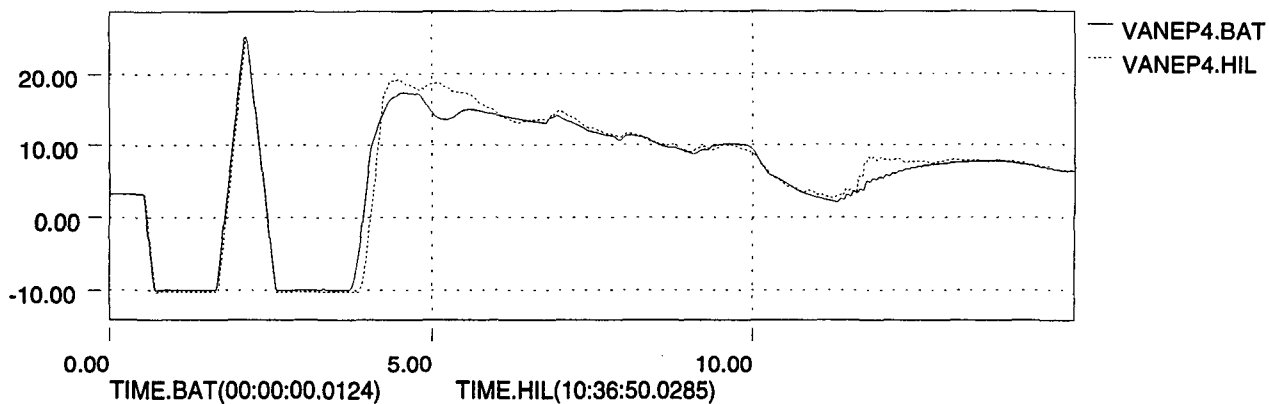
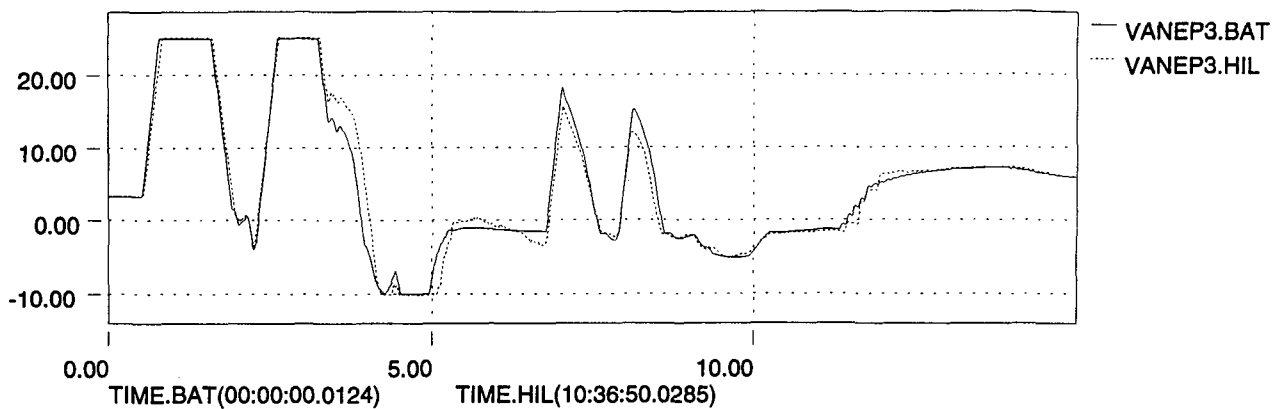
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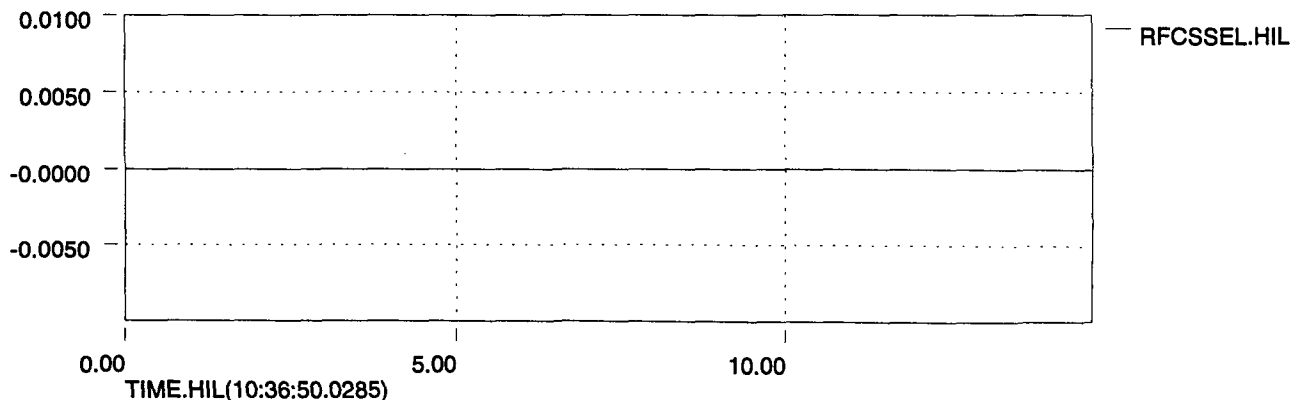
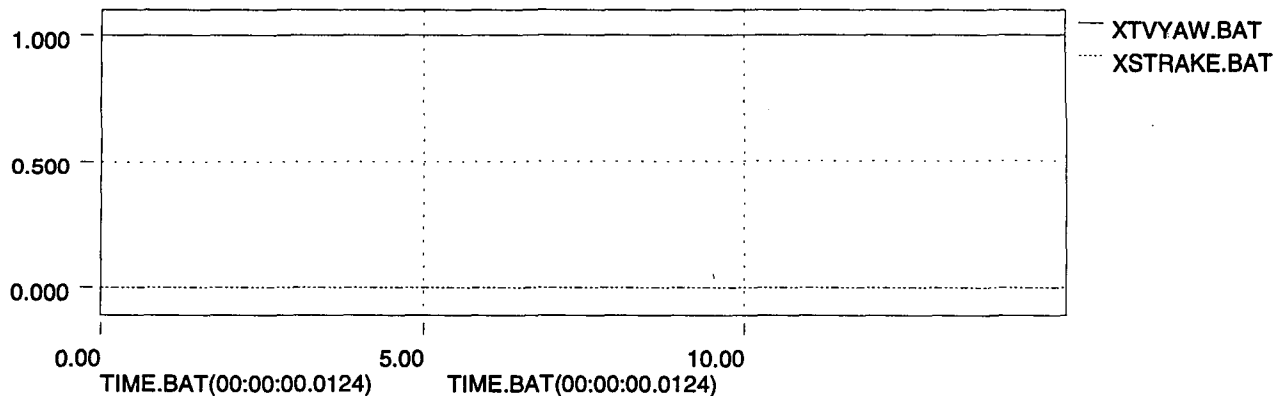
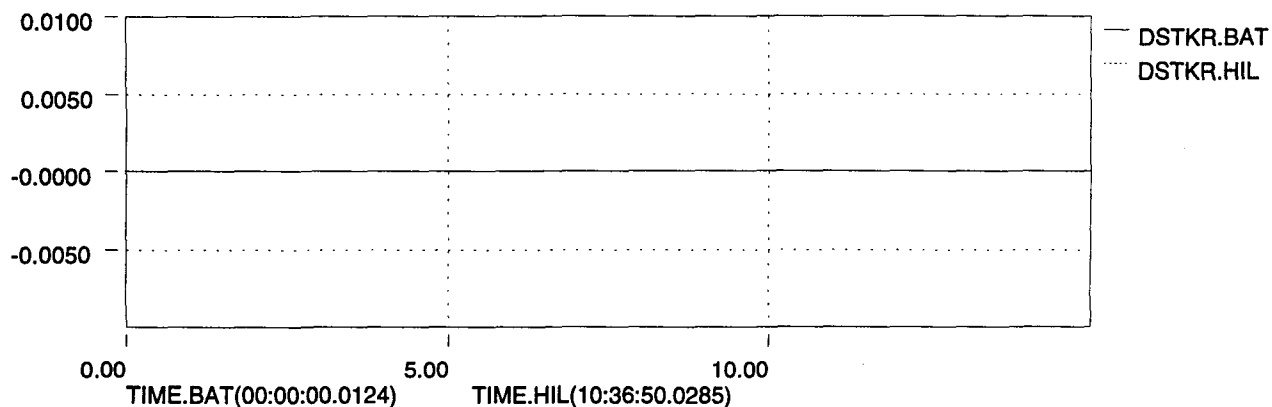
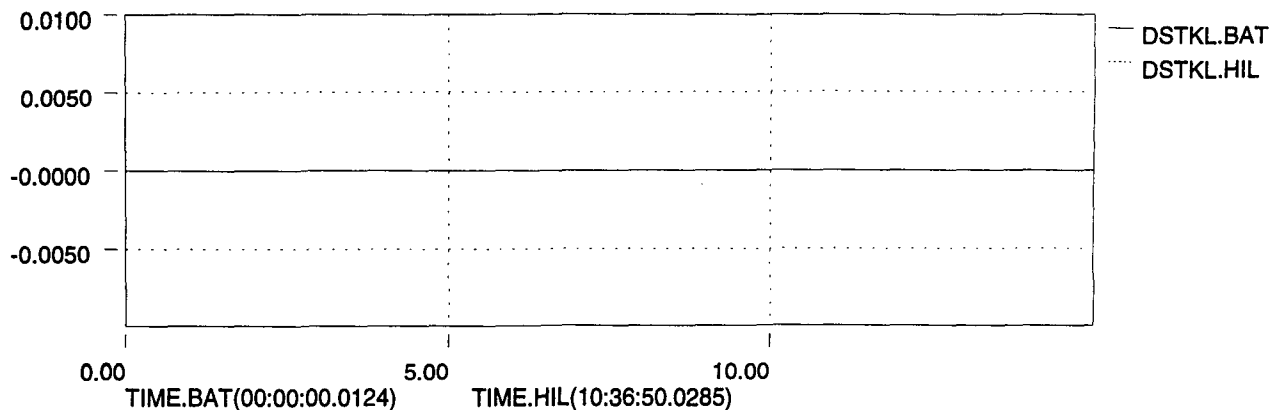






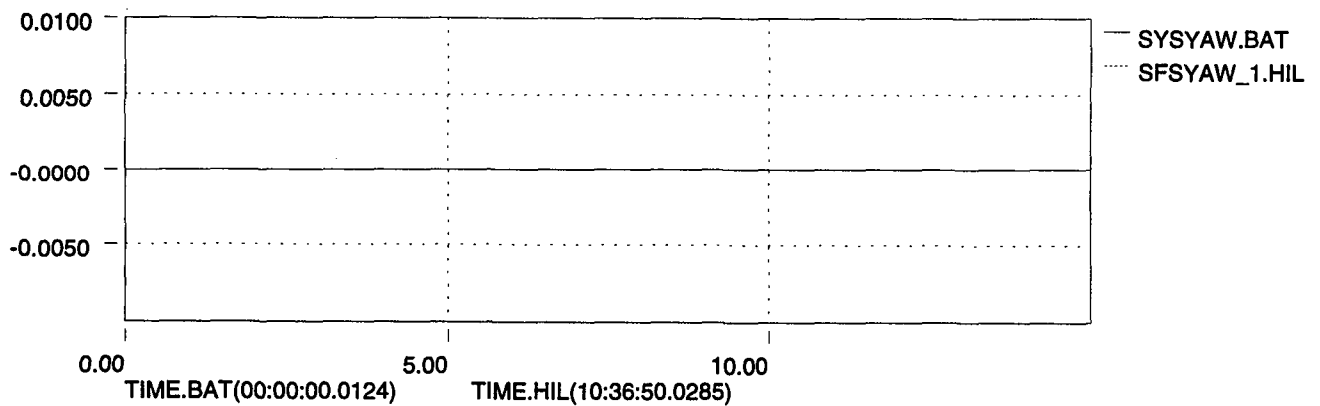
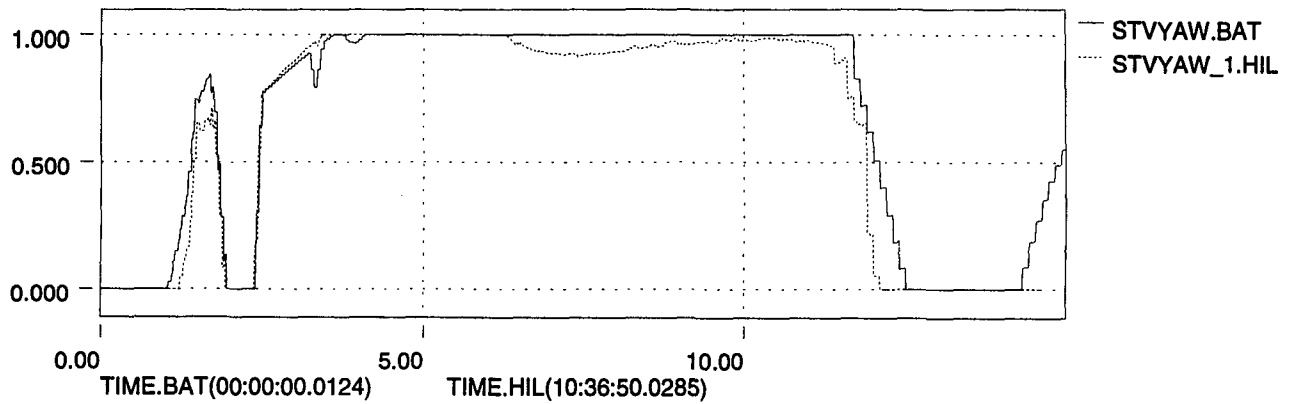
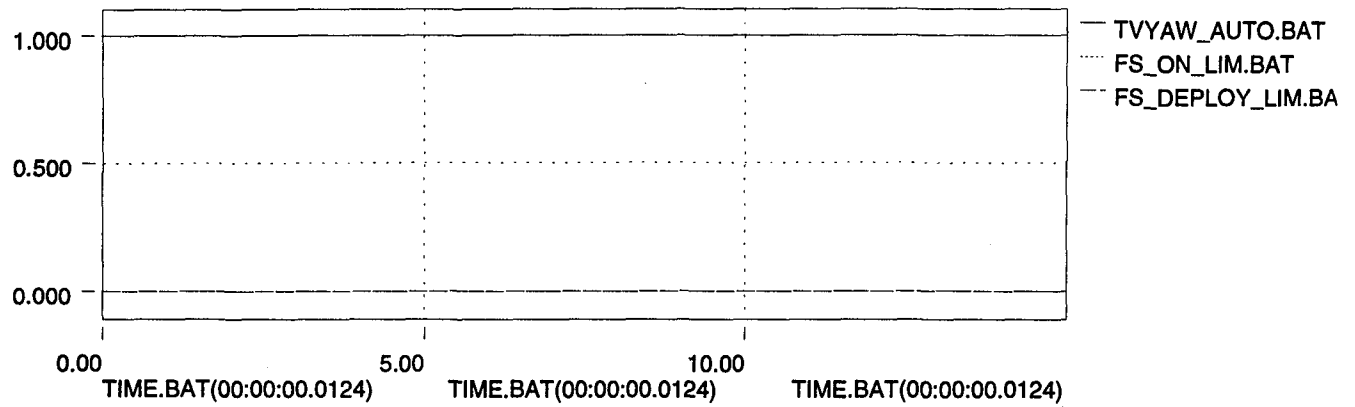
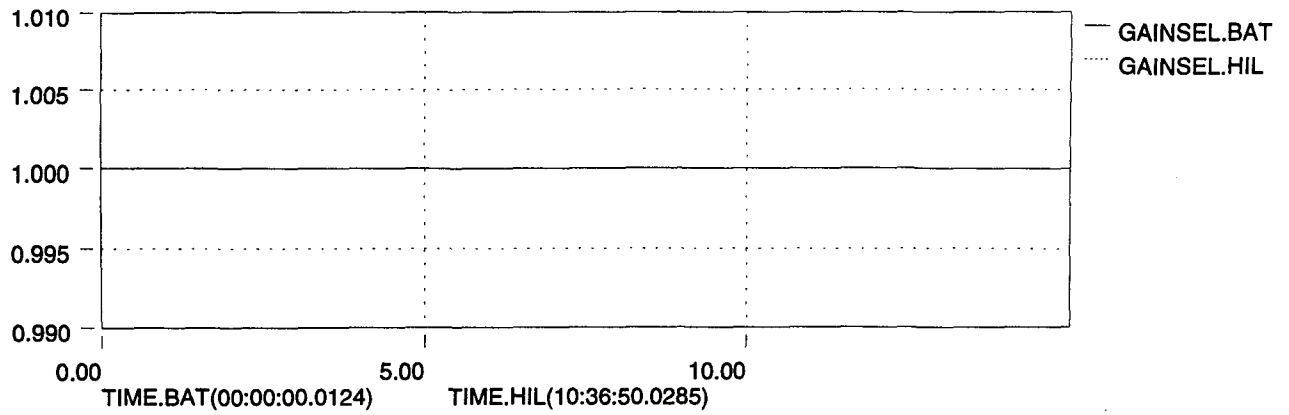
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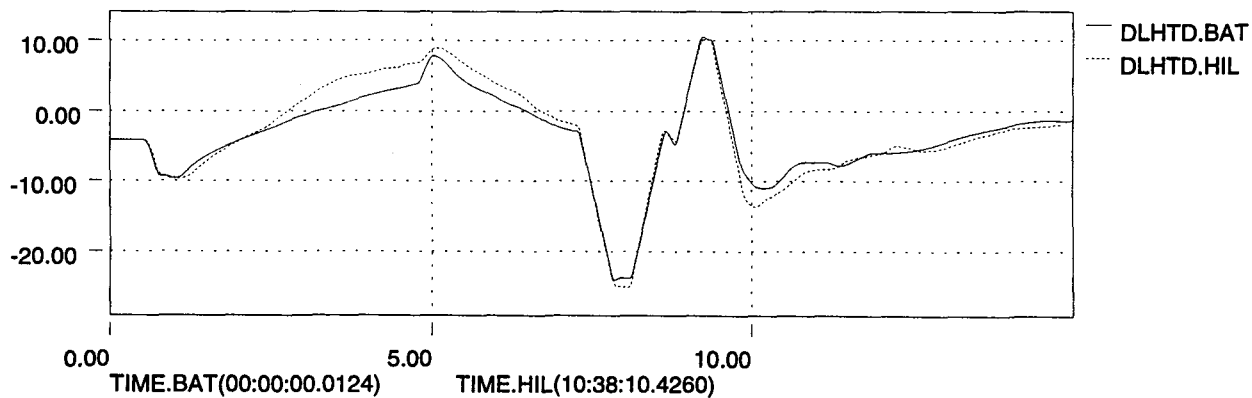
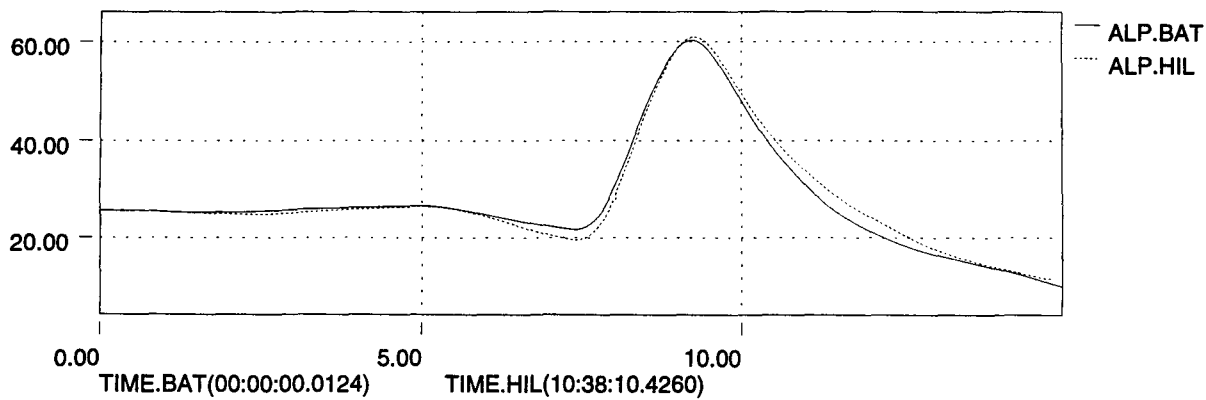
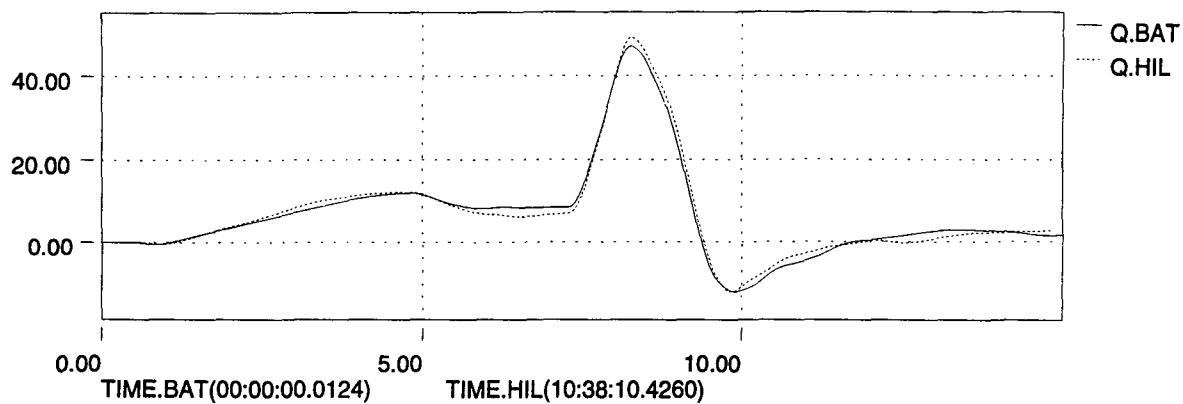
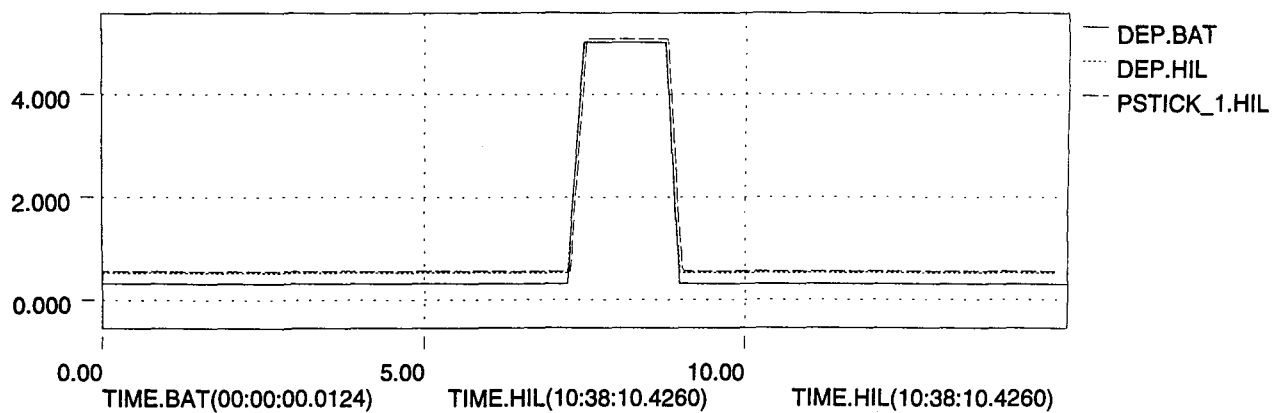
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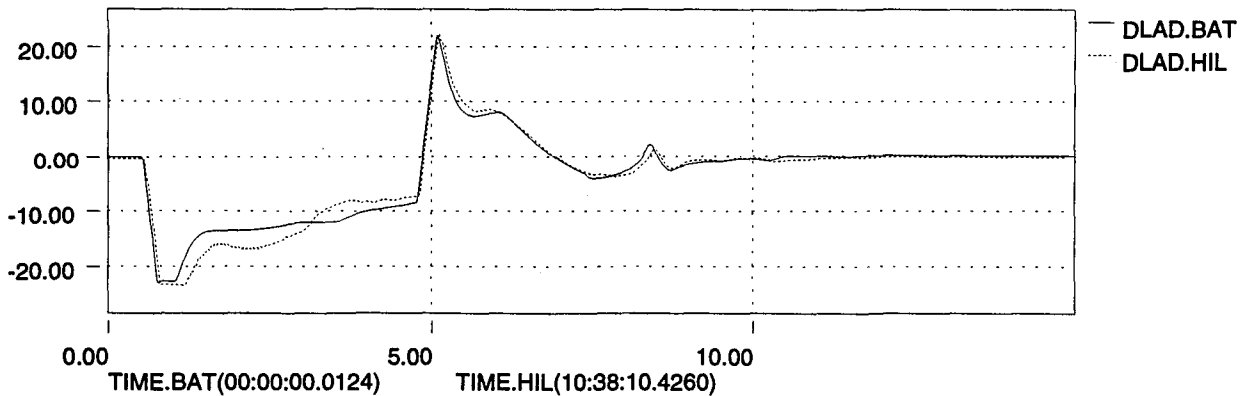
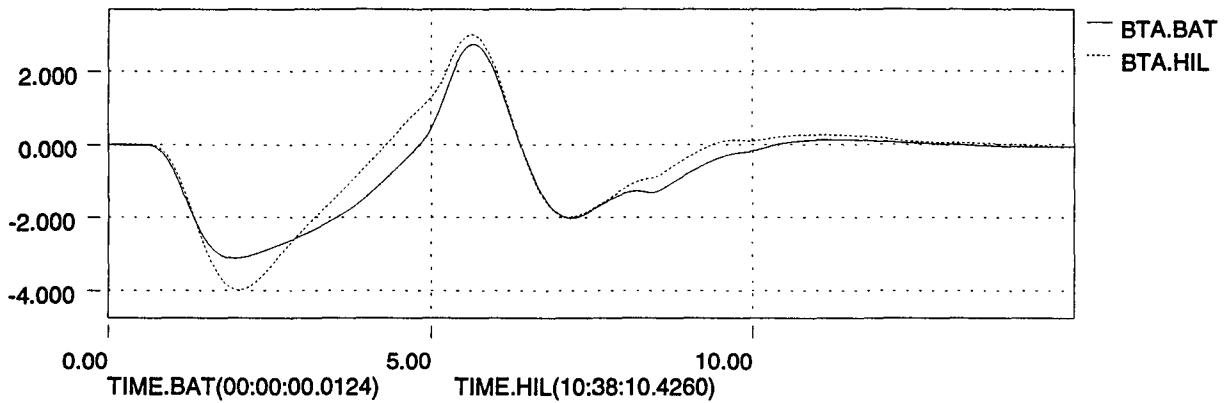
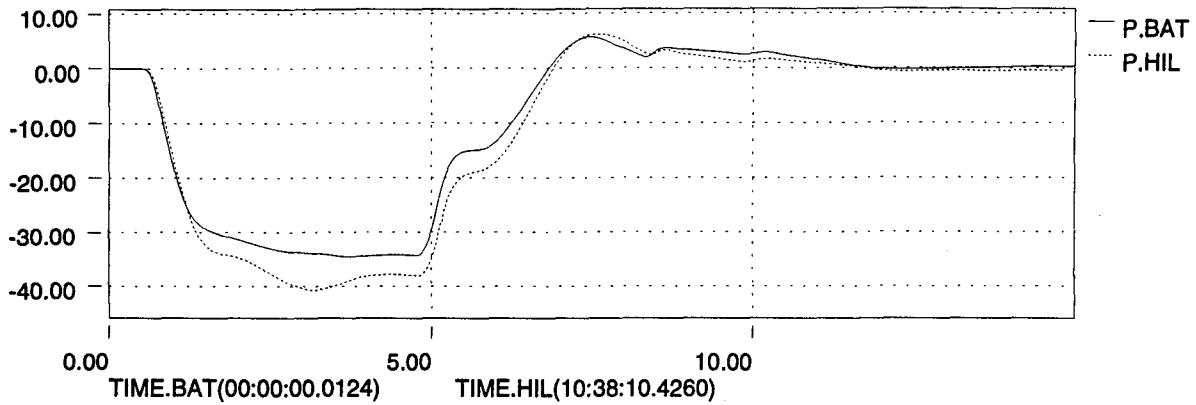
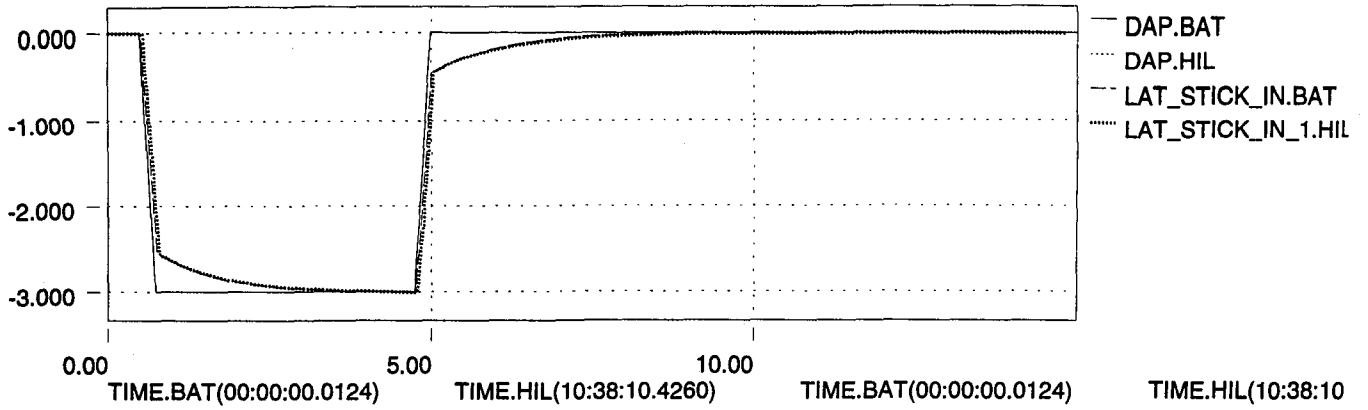
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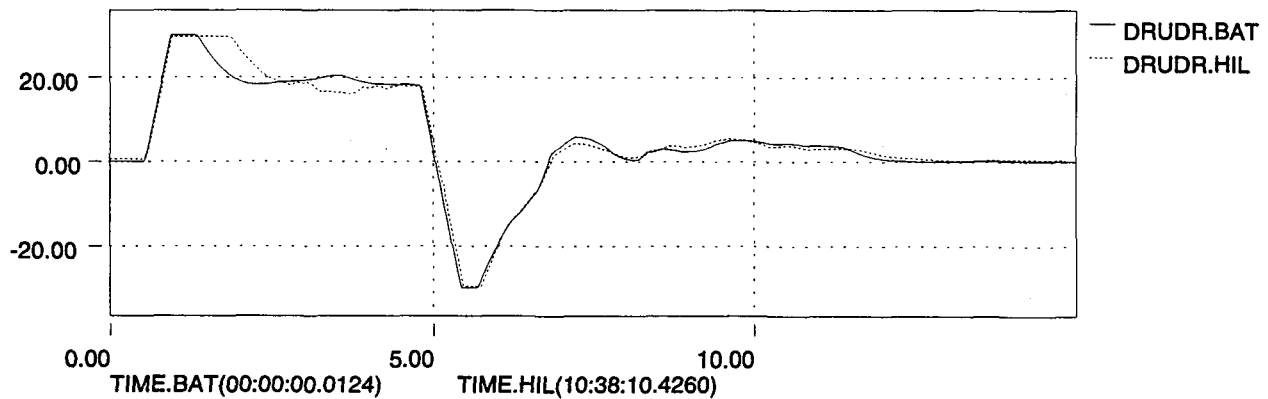
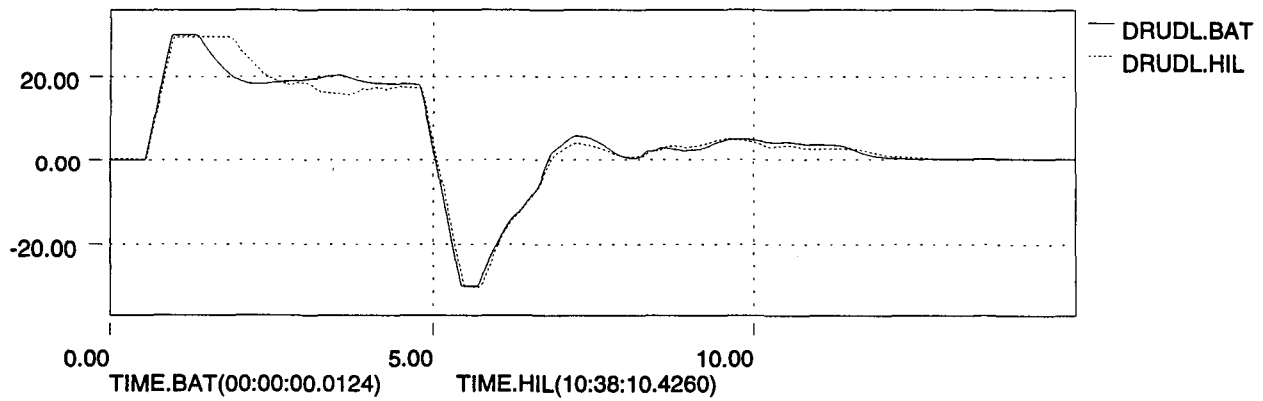
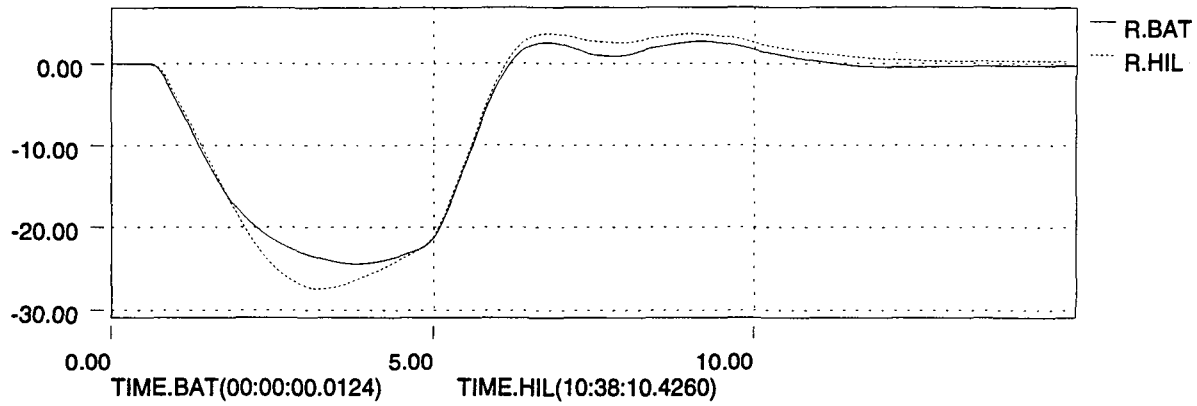
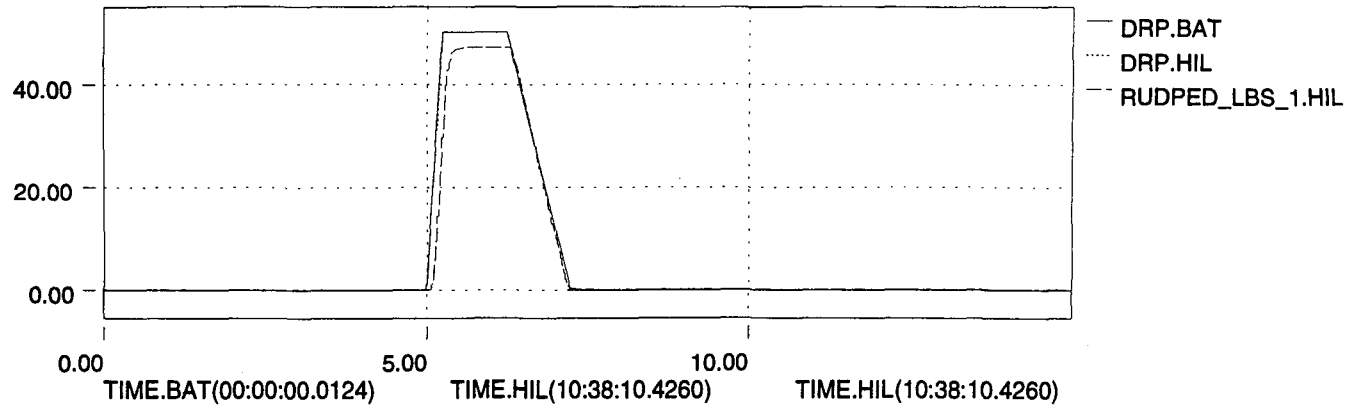


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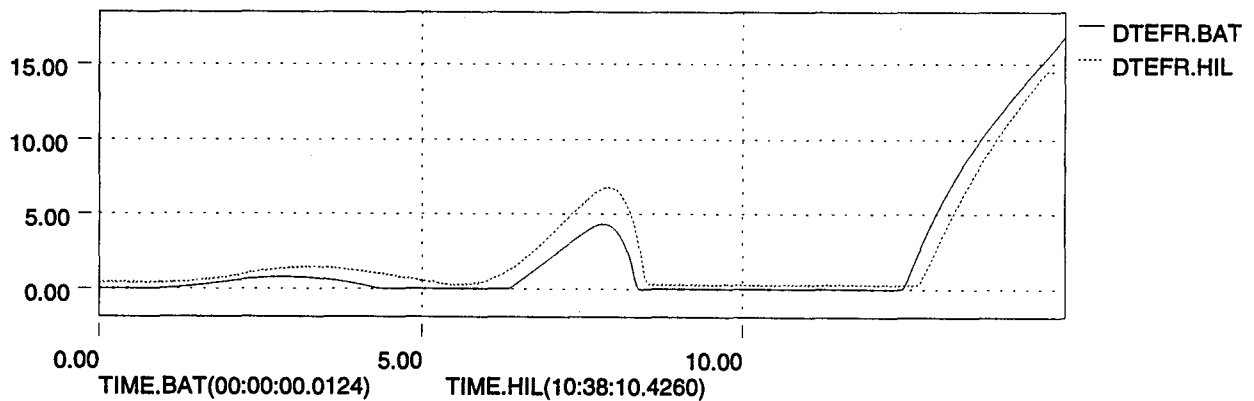
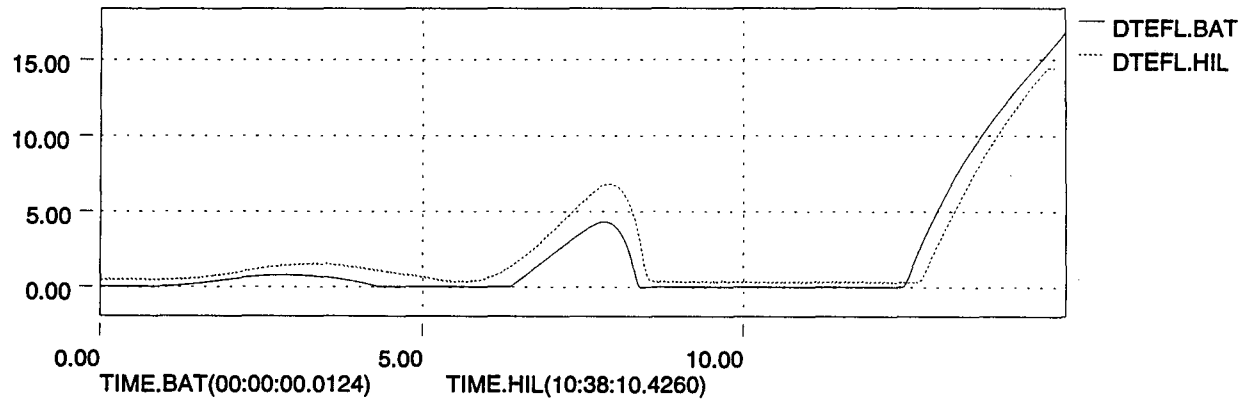
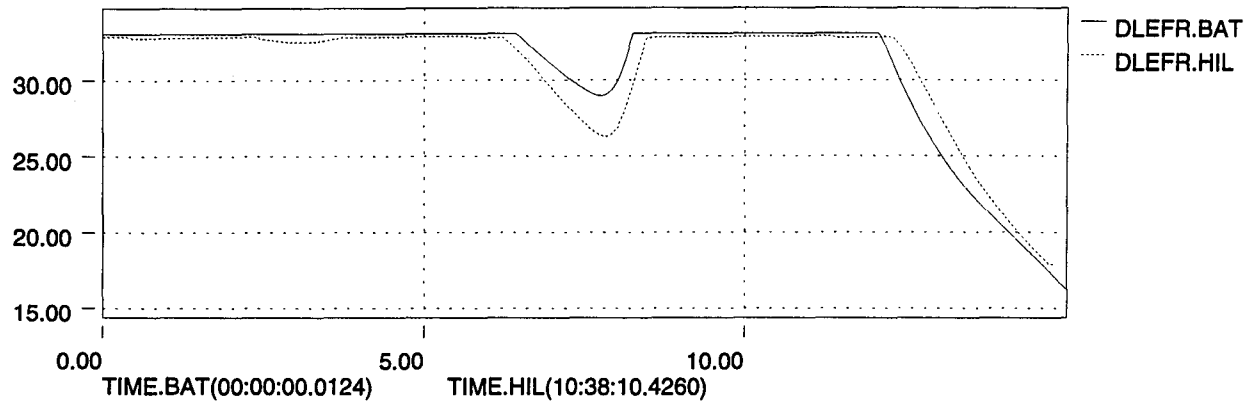
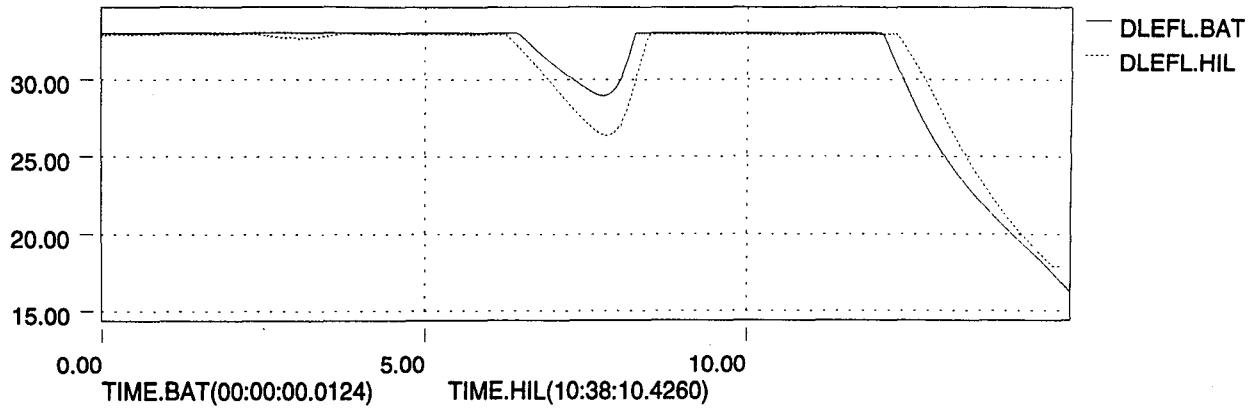






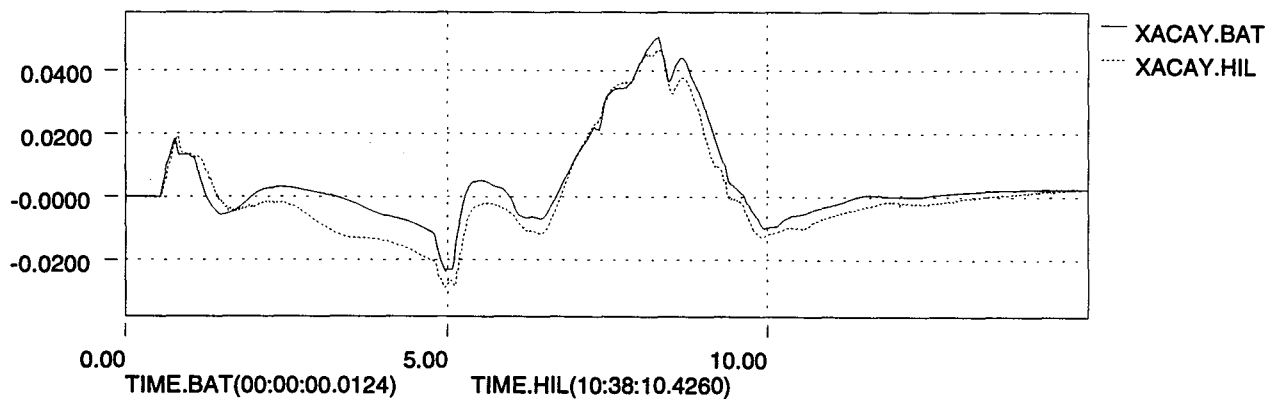
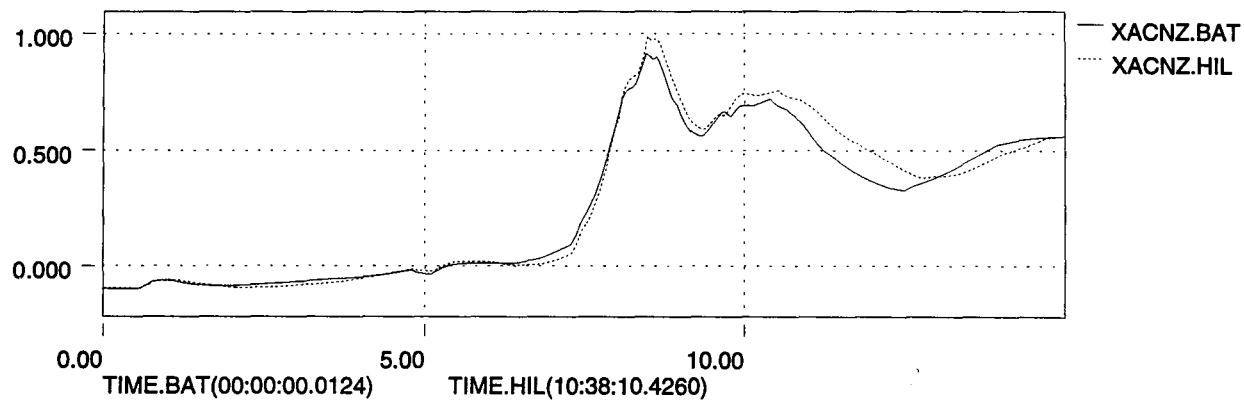
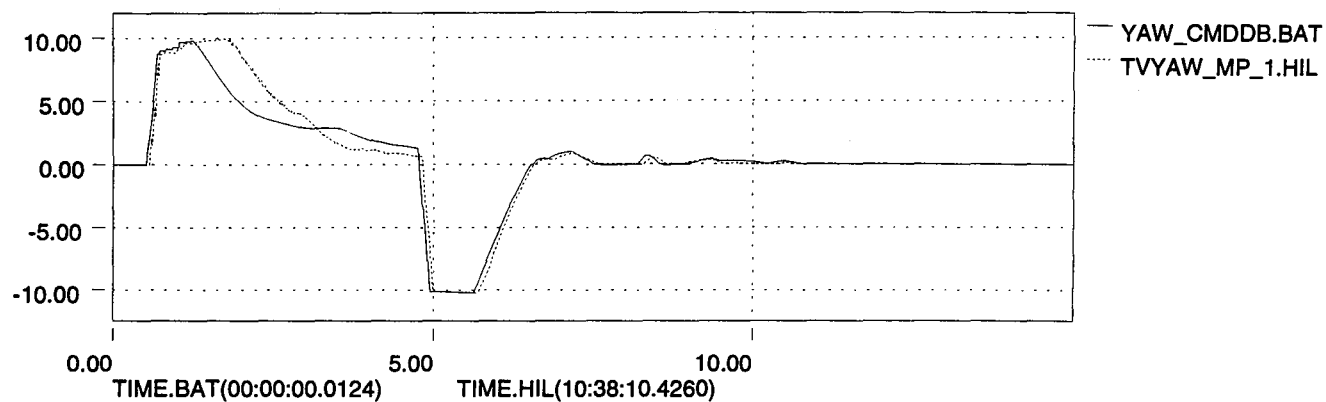
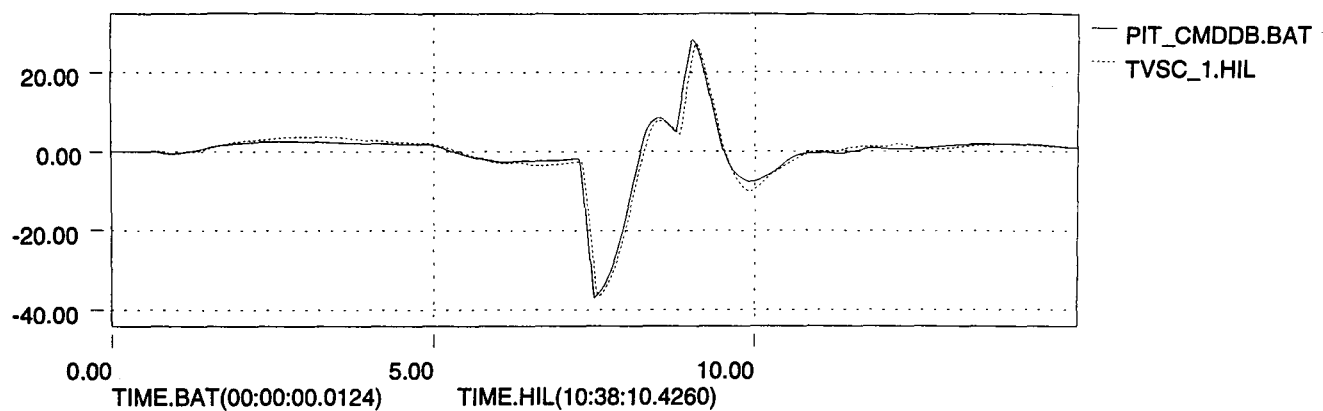
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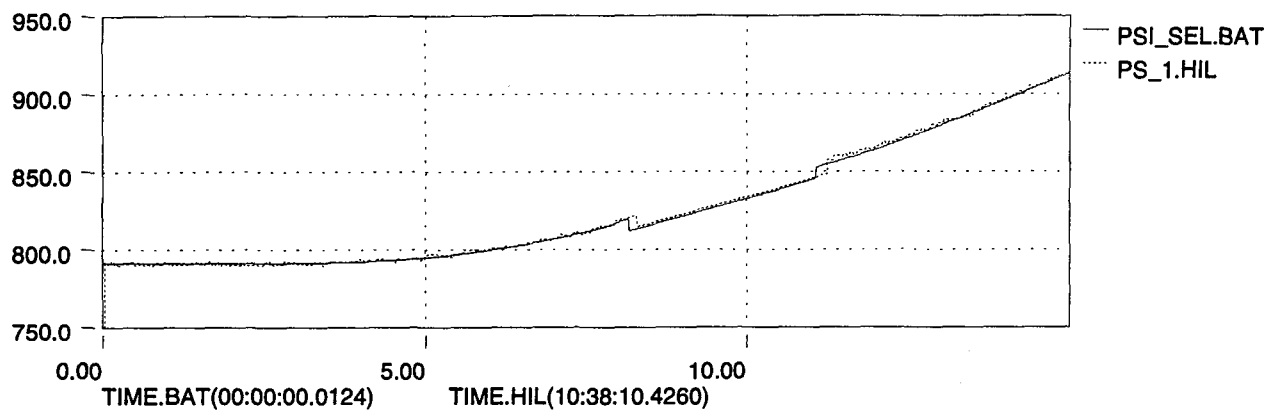
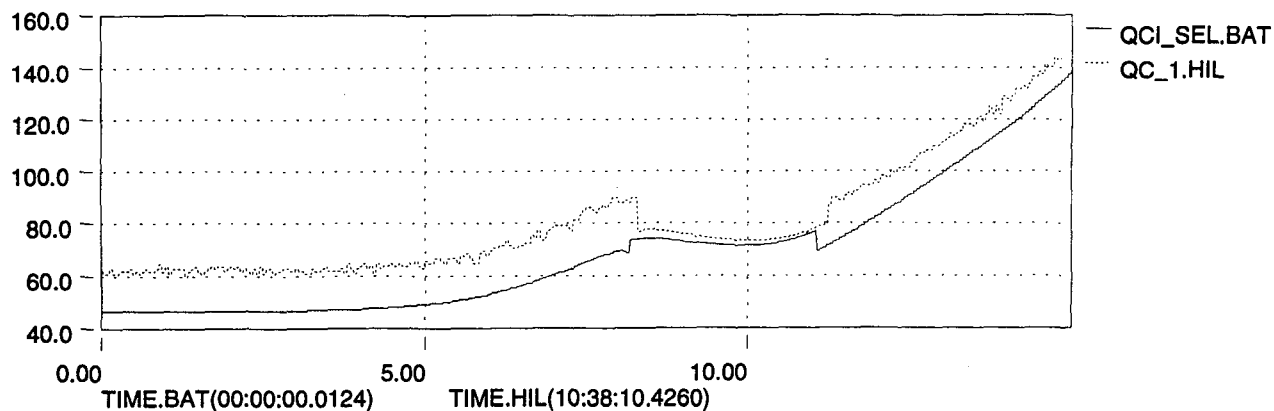
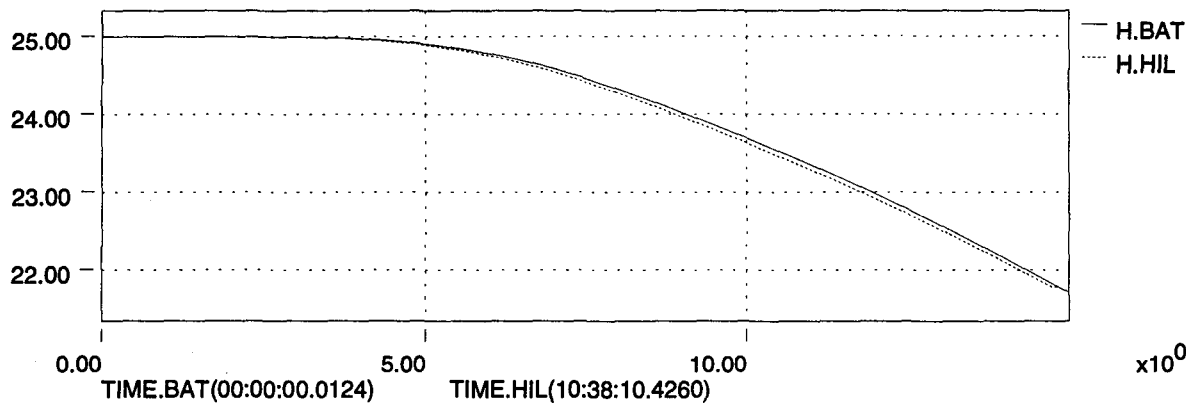
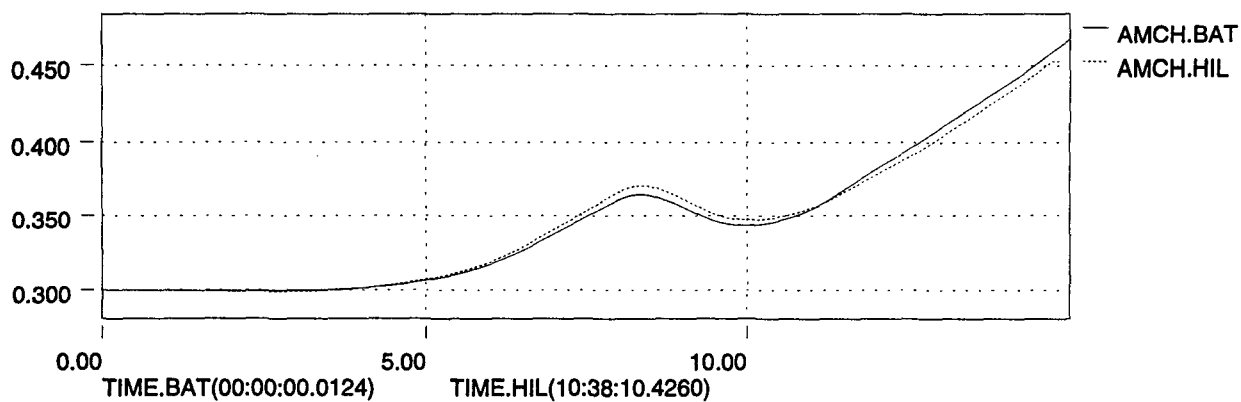
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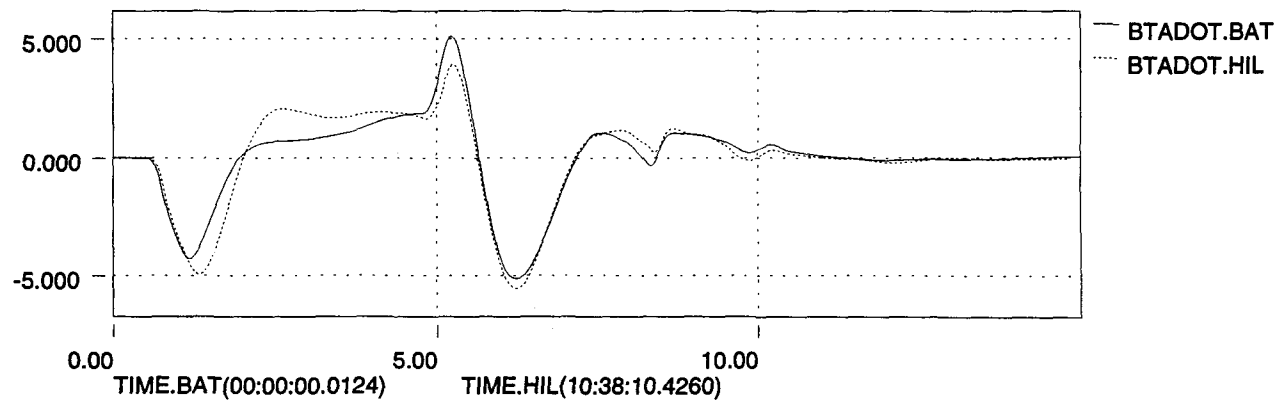
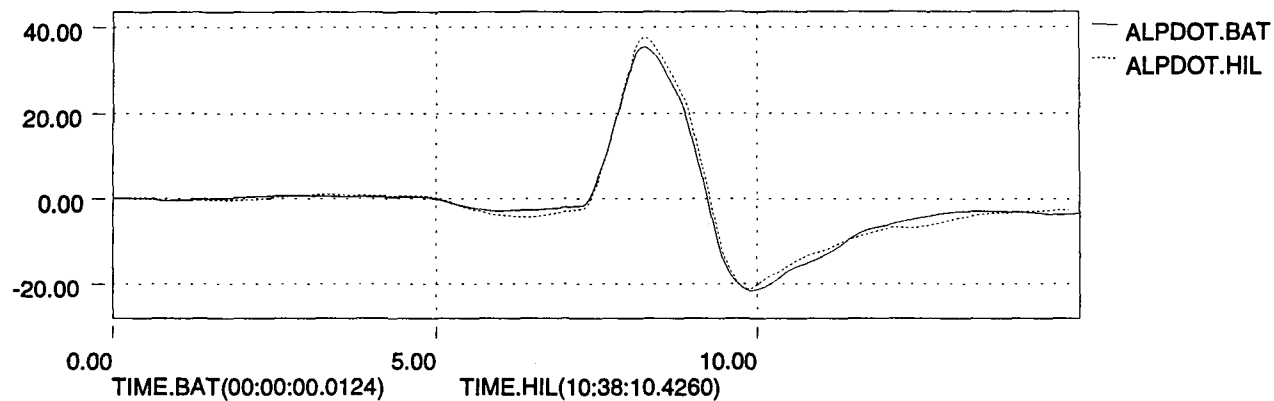
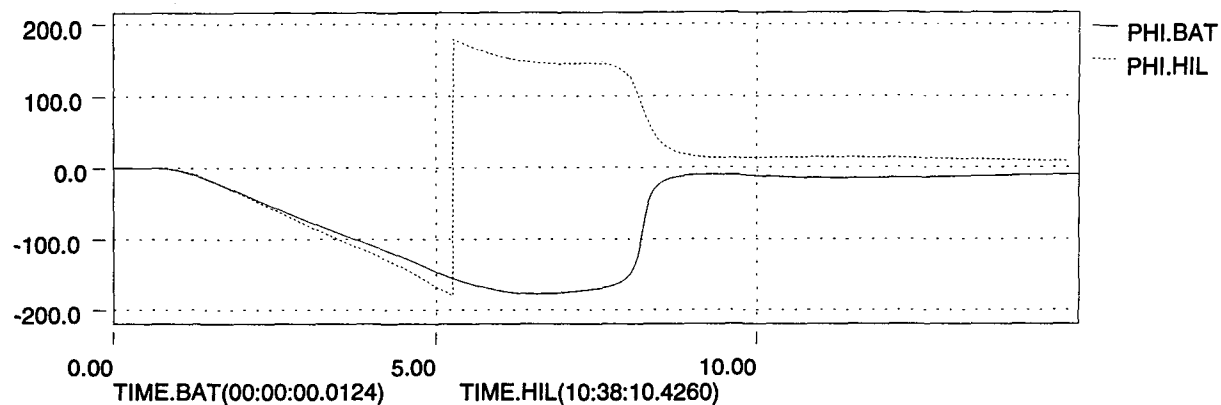
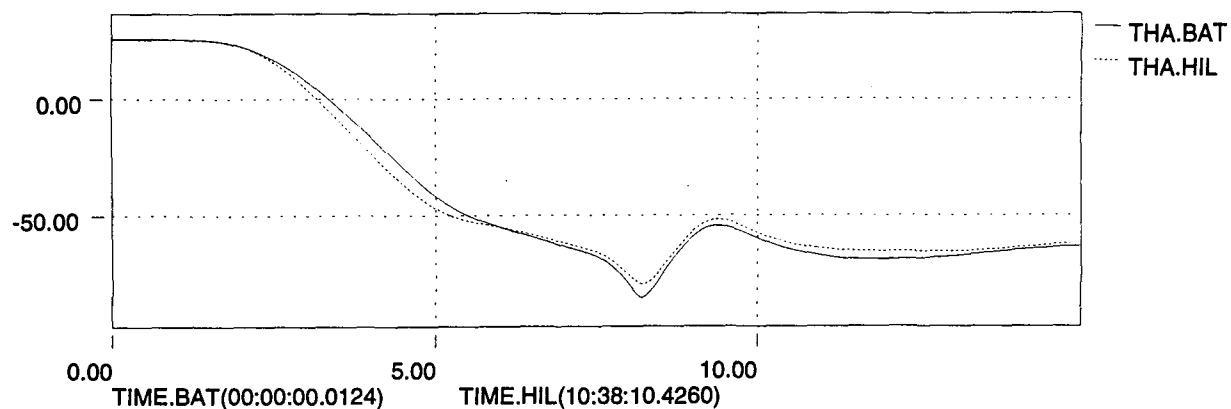
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 $\times 10^3$  $\times 10^0$ 

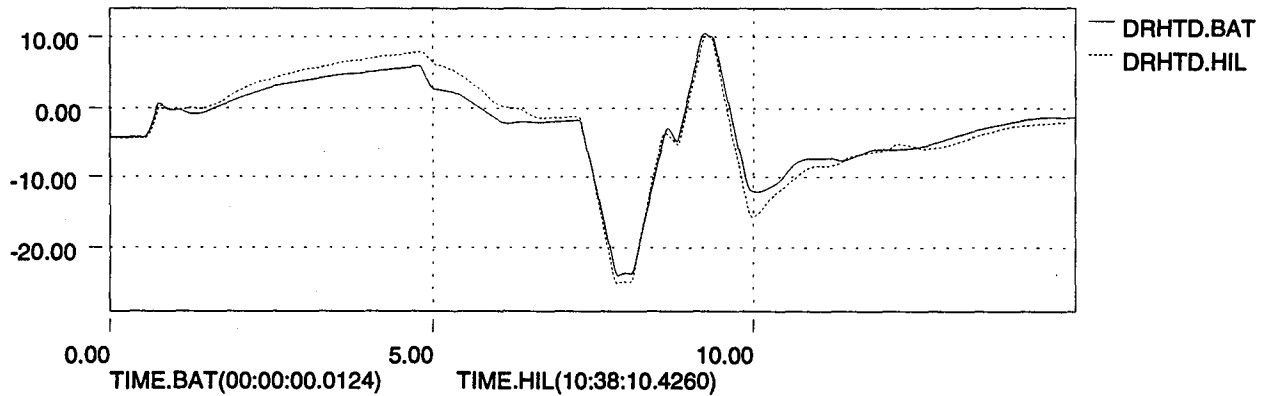
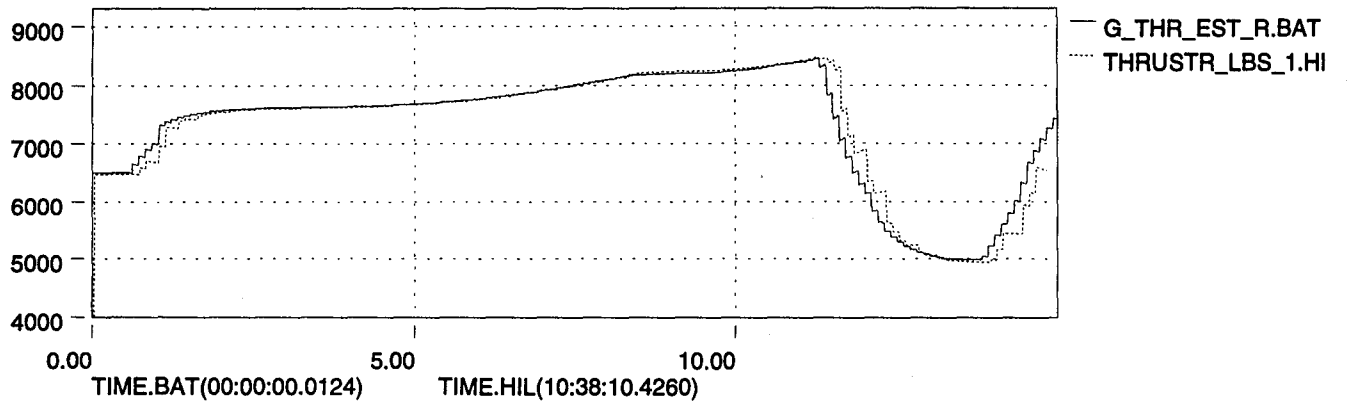
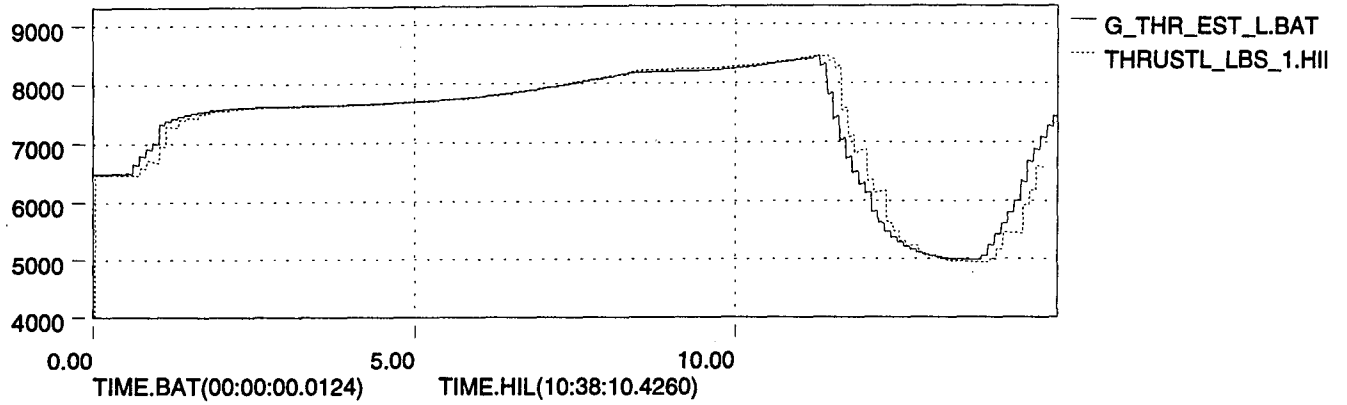
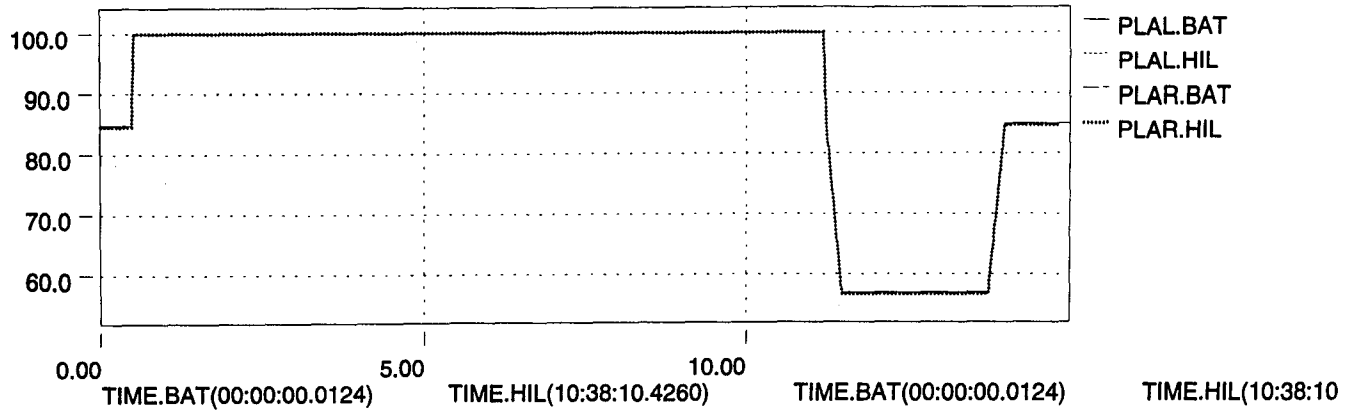
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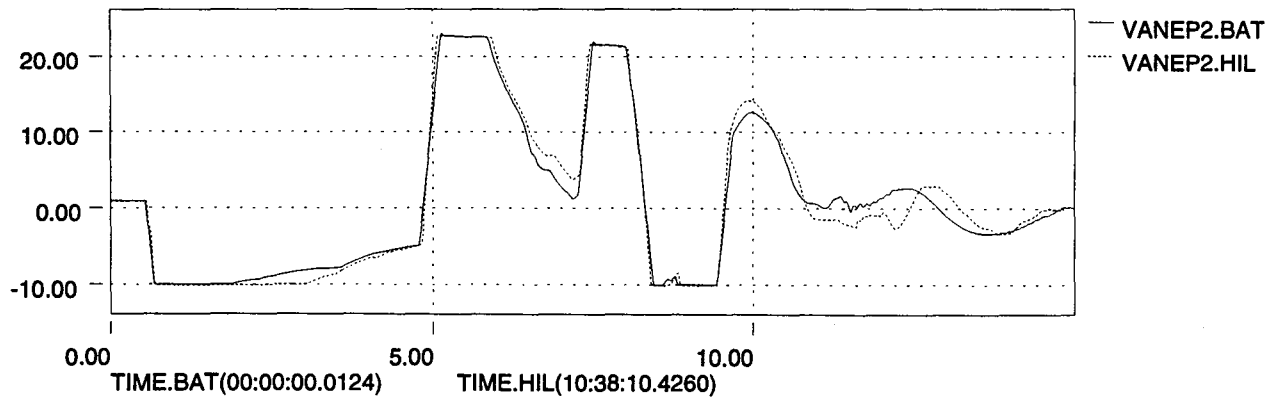
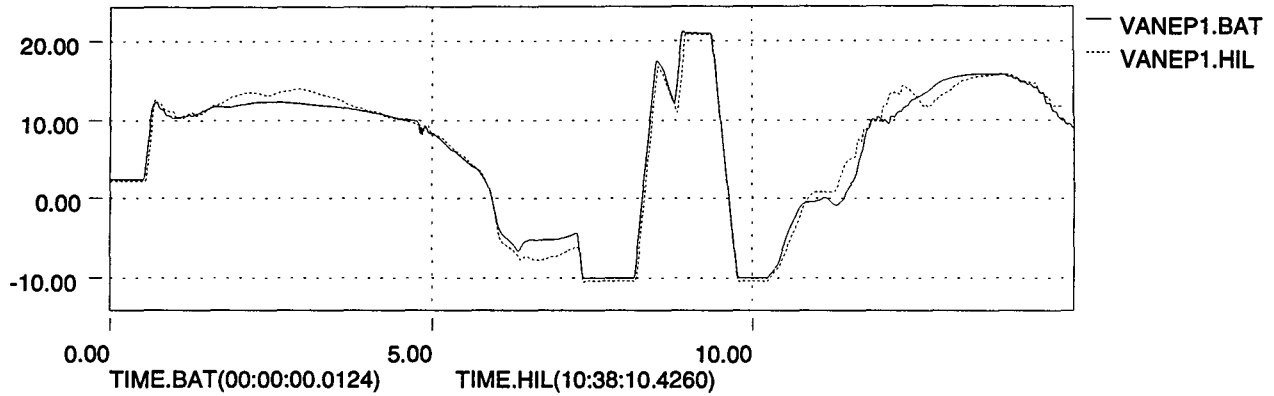
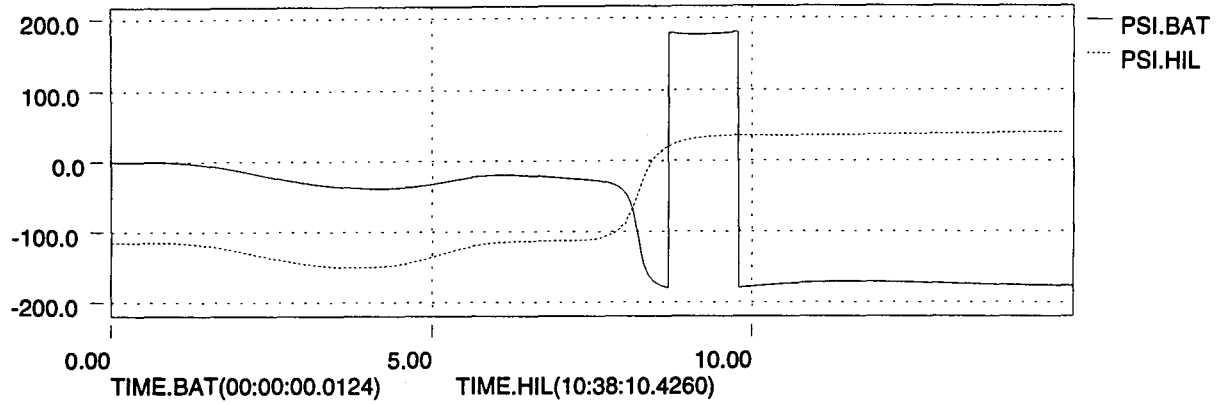
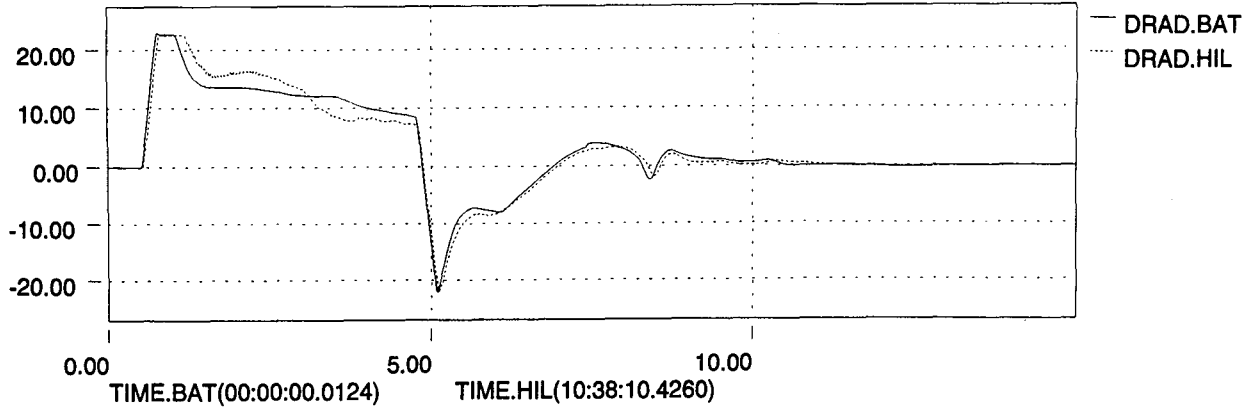
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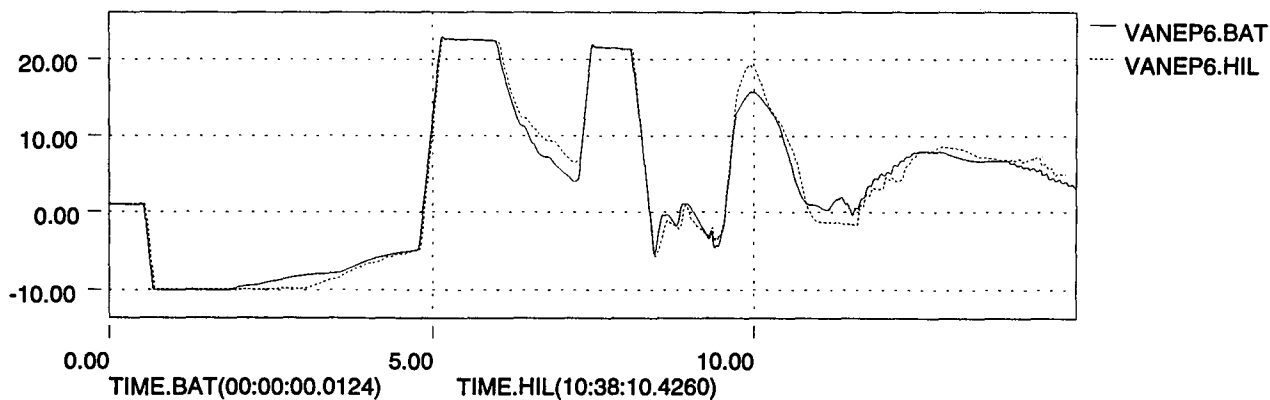
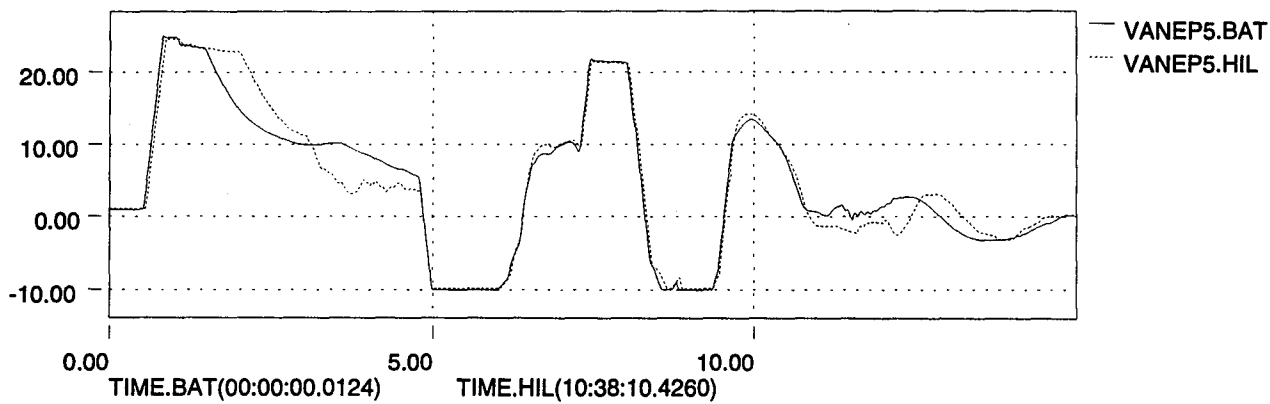
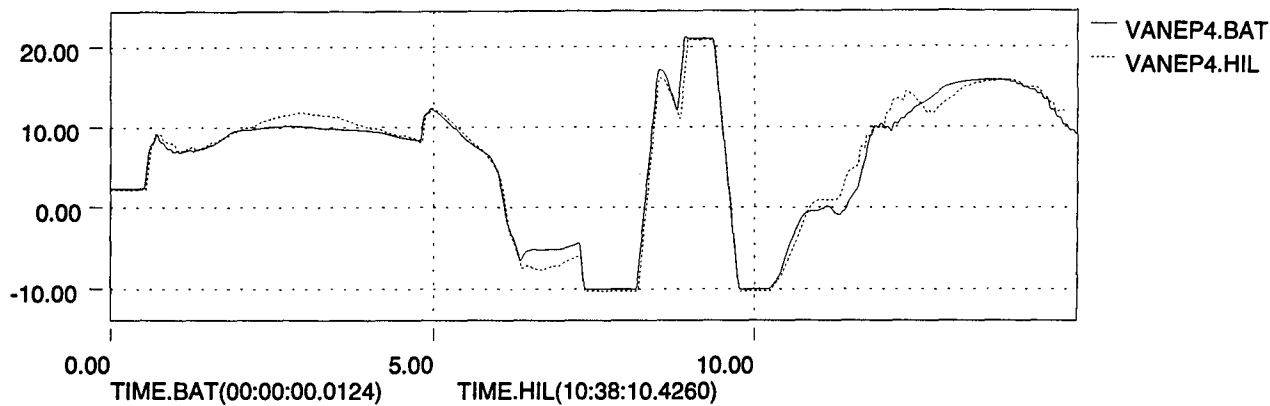
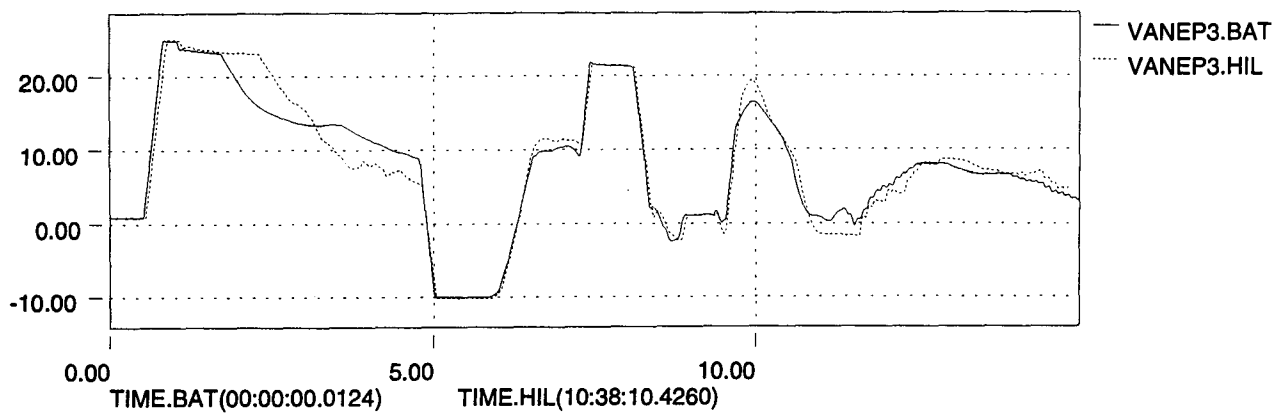


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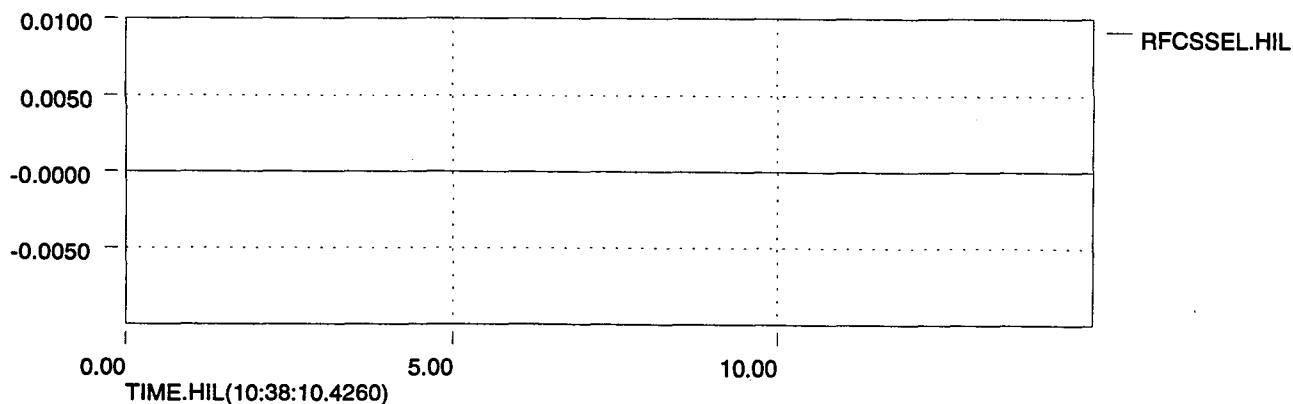
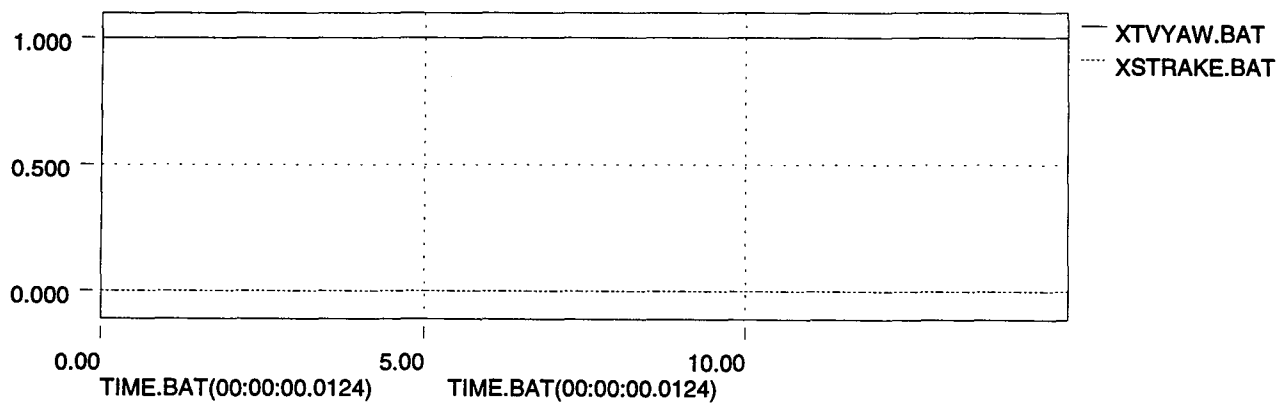
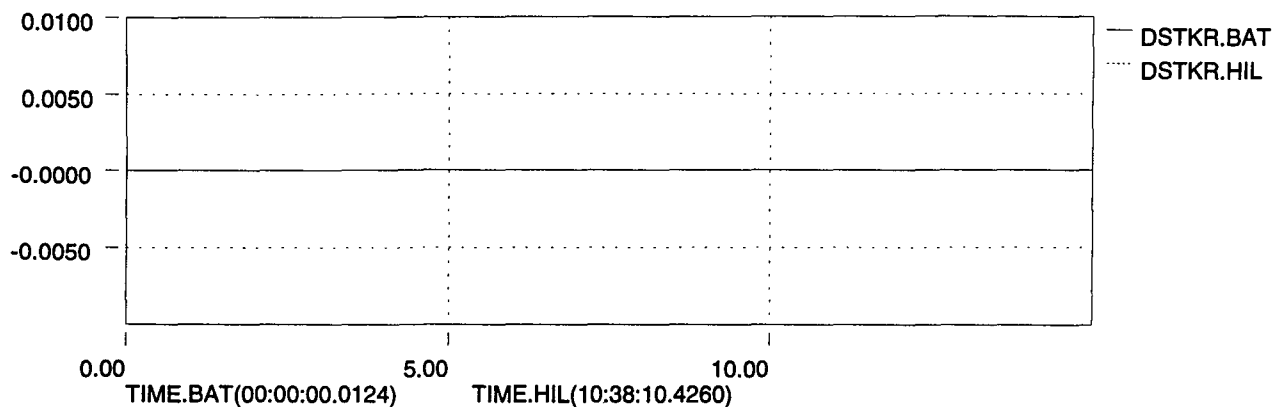
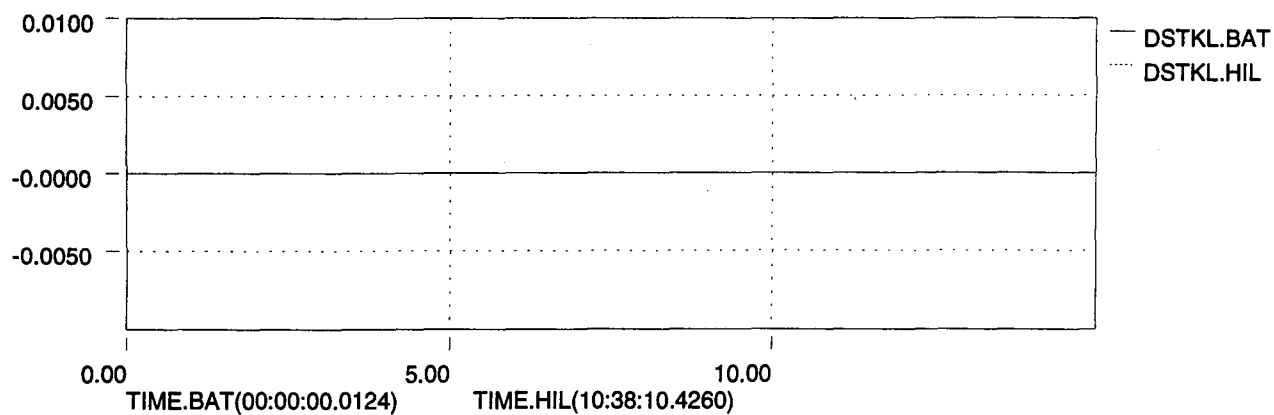
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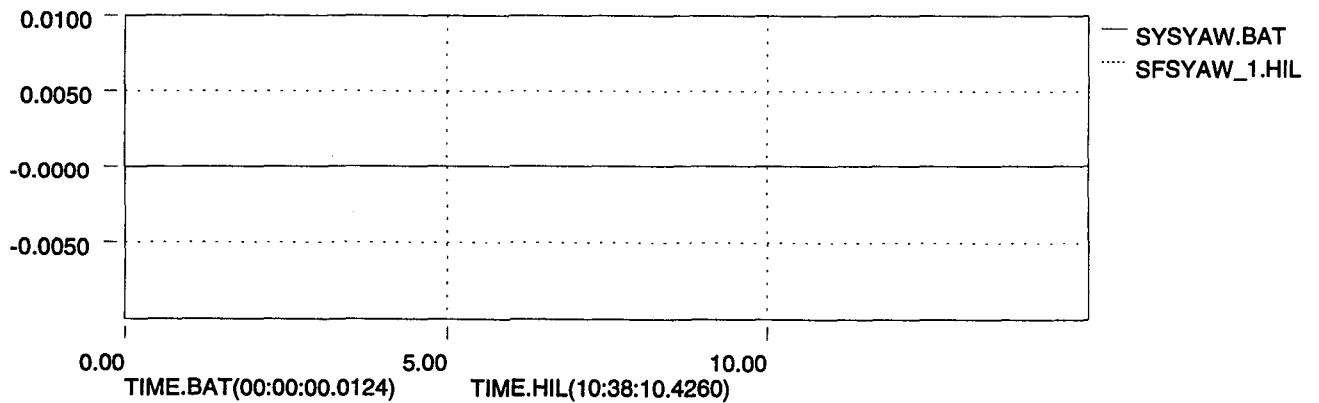
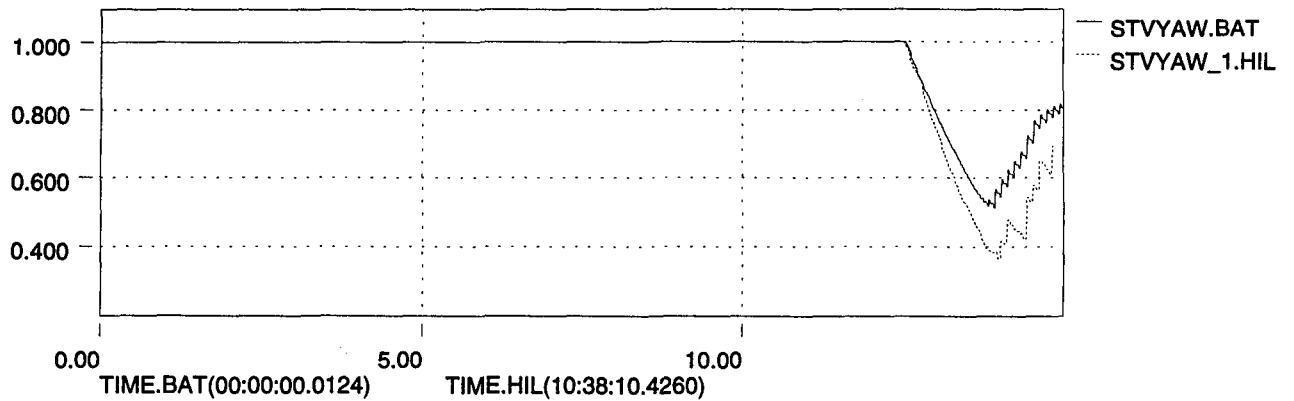
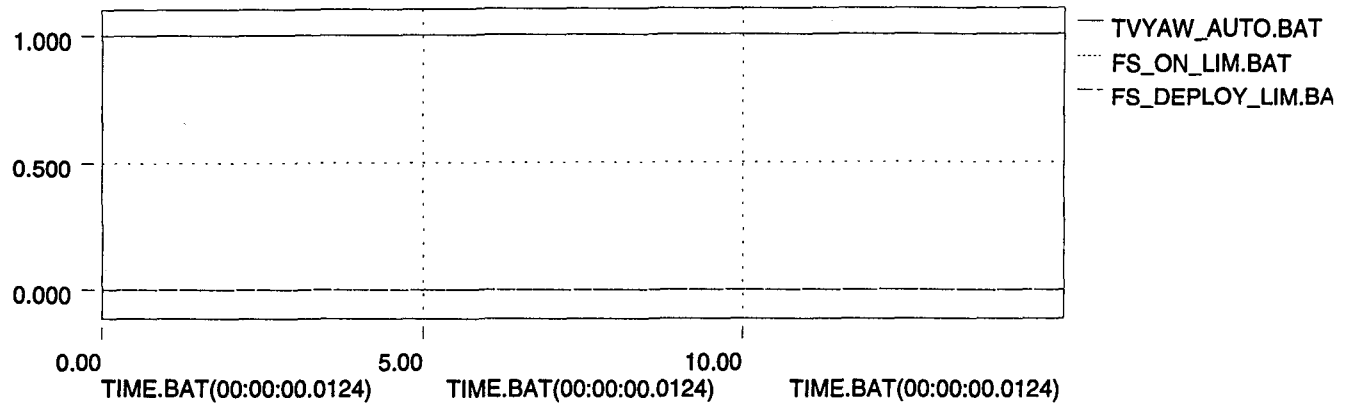
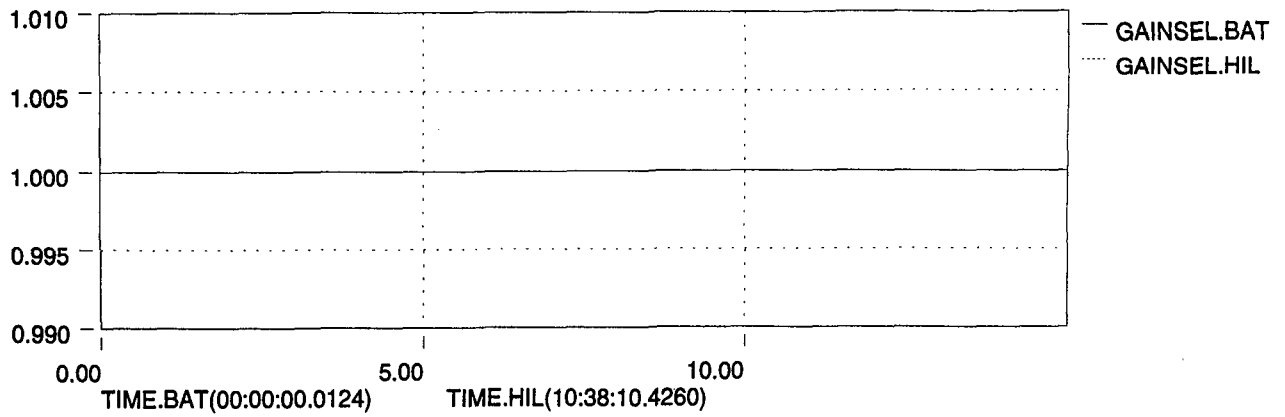


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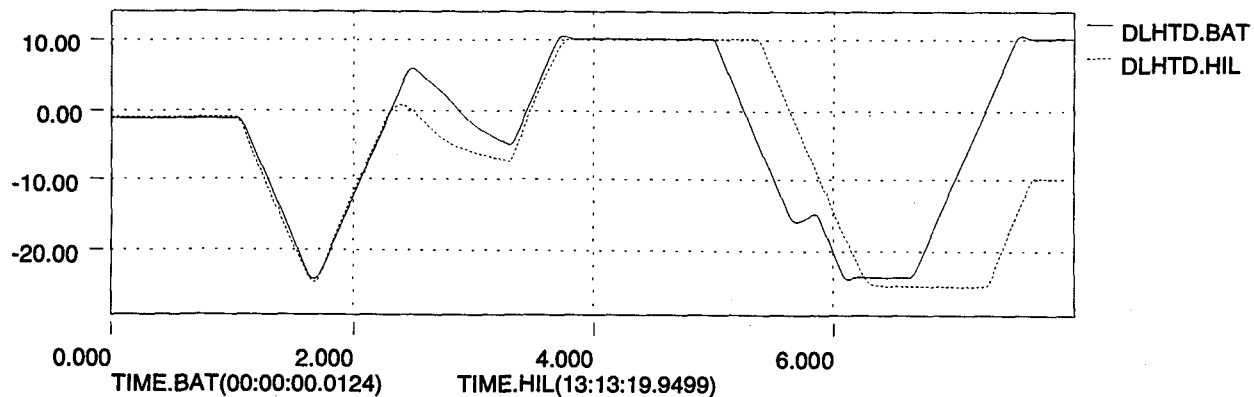
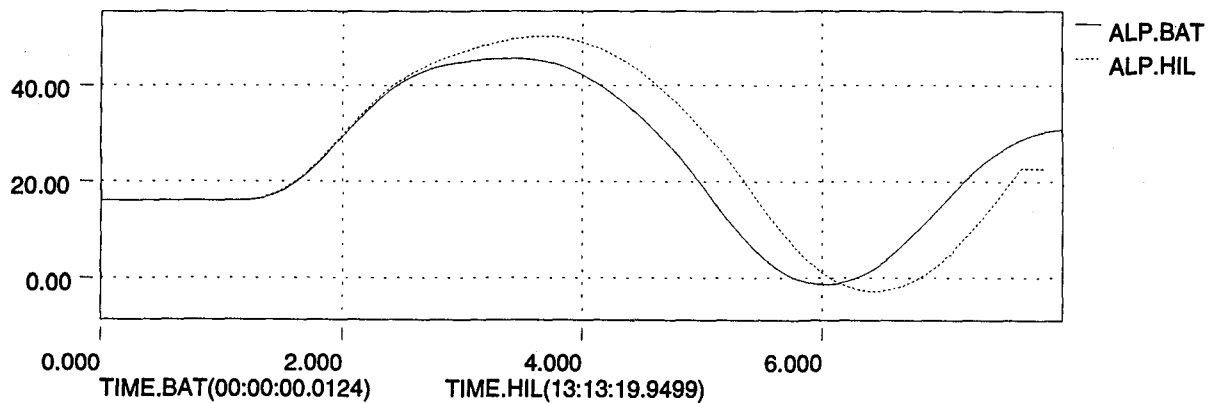
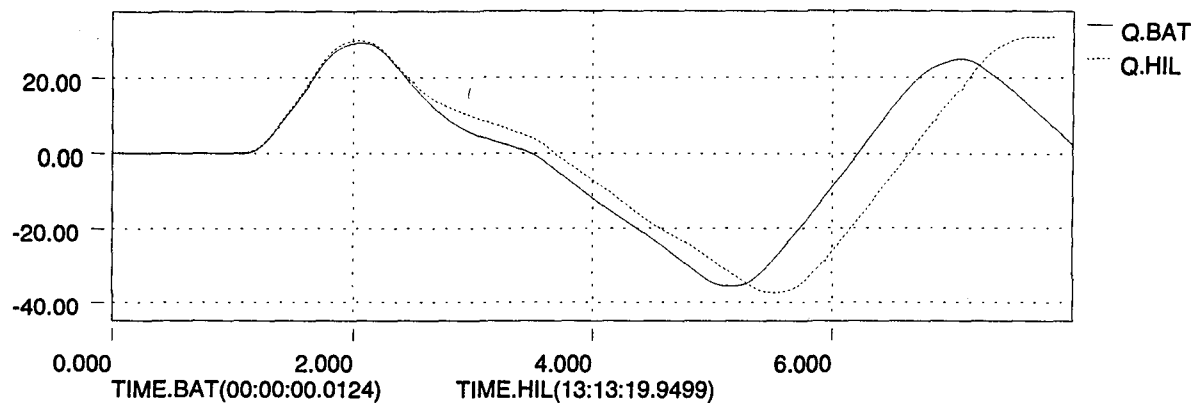
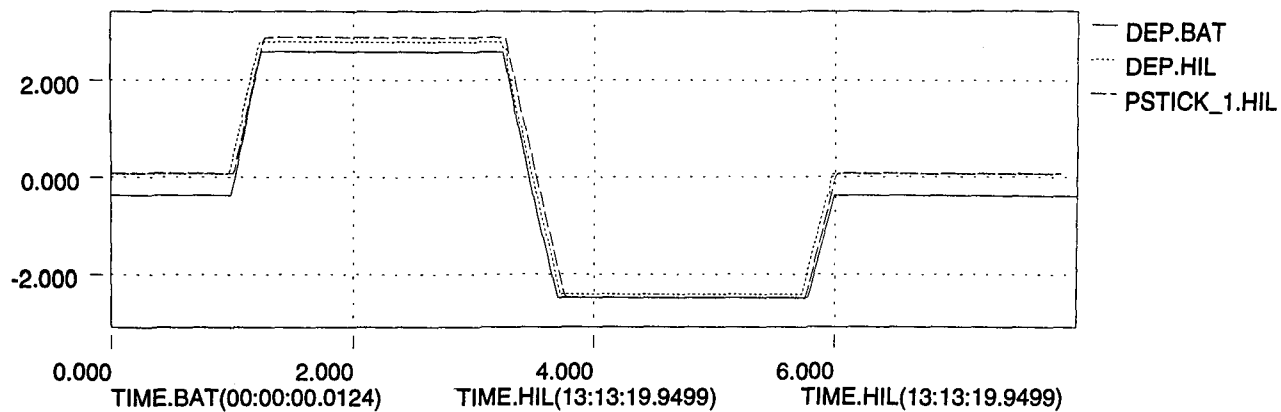
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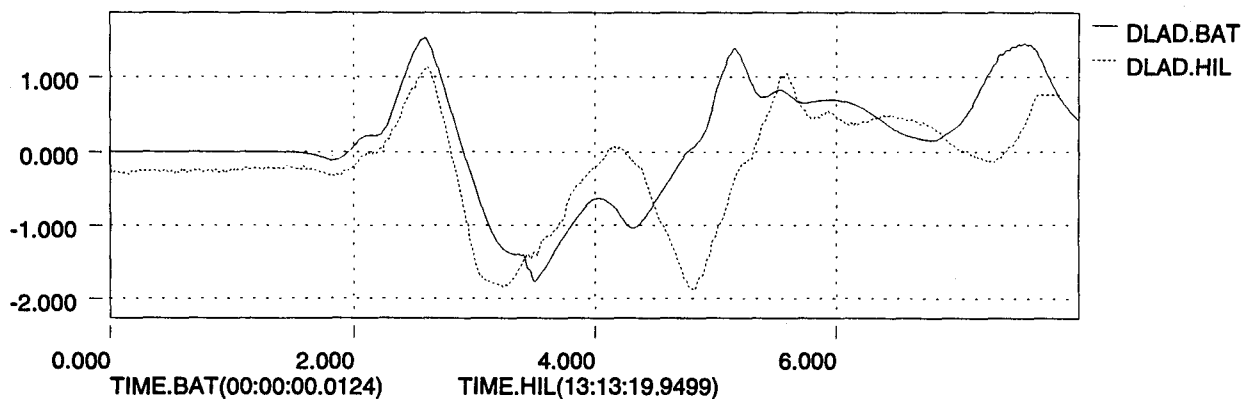
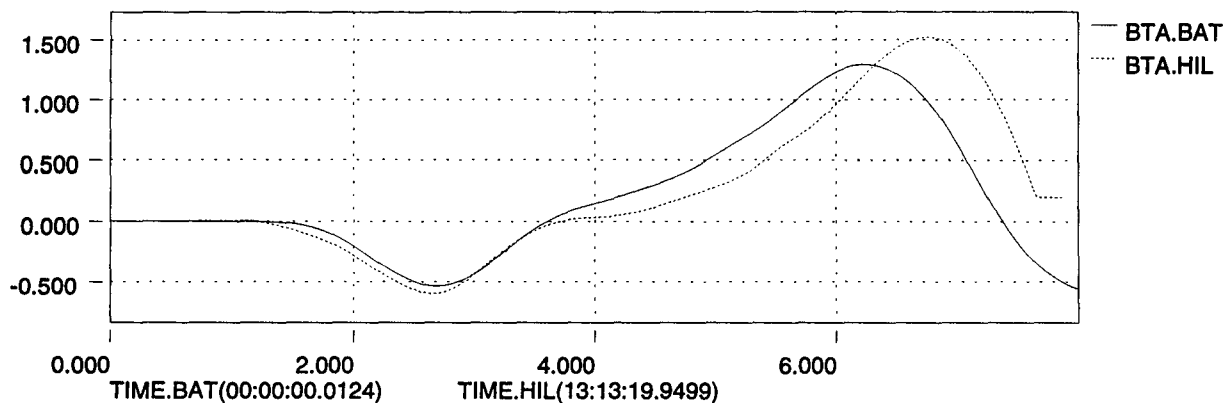
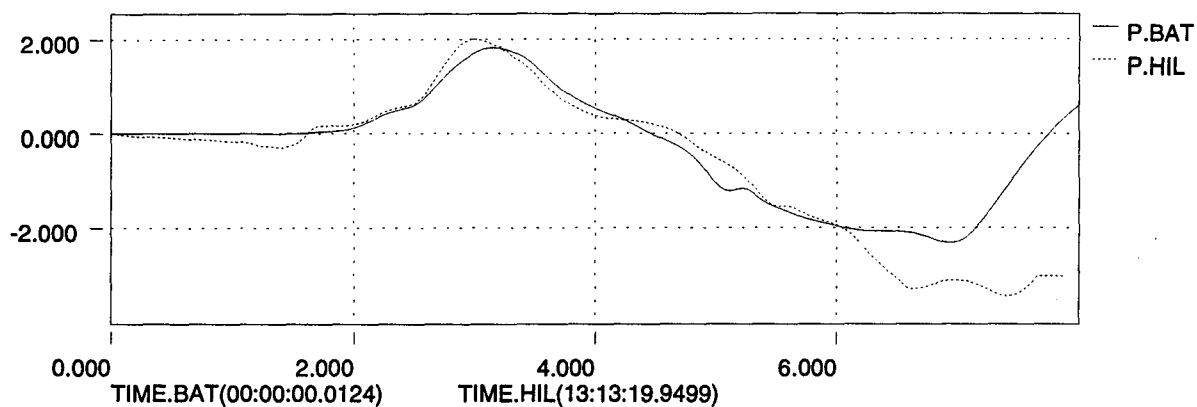
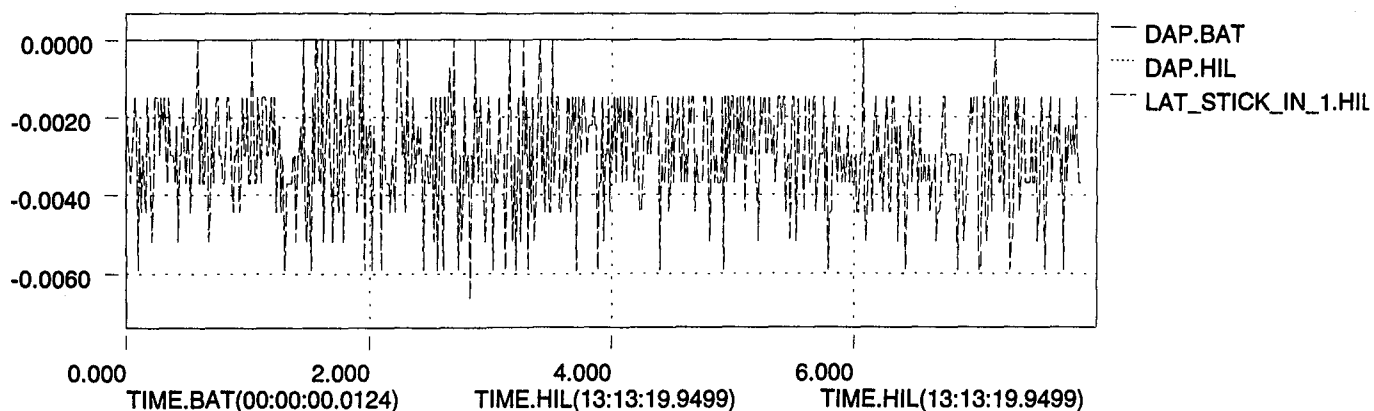




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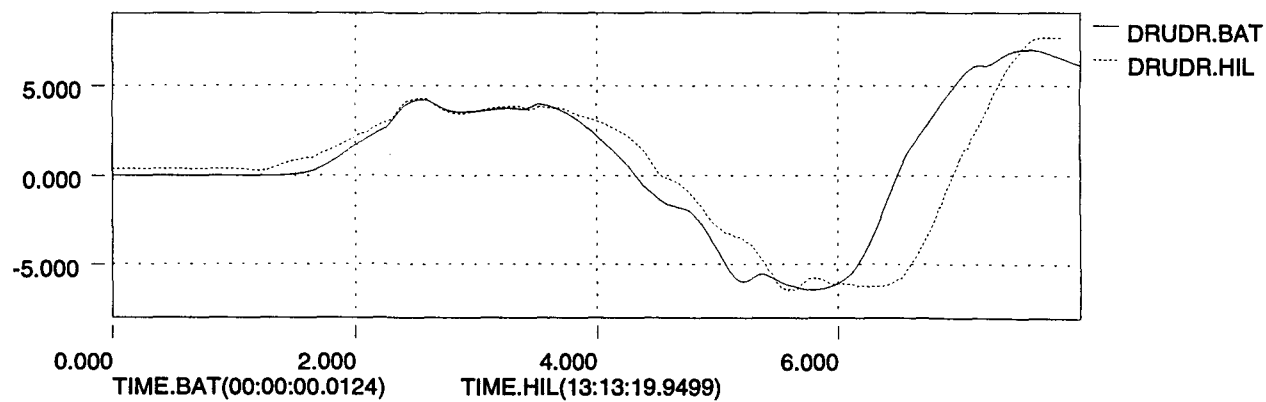
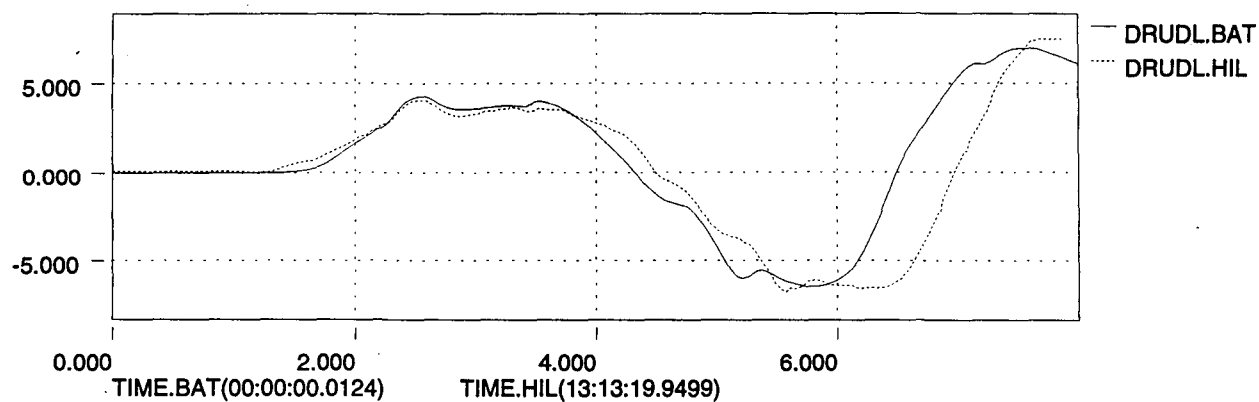
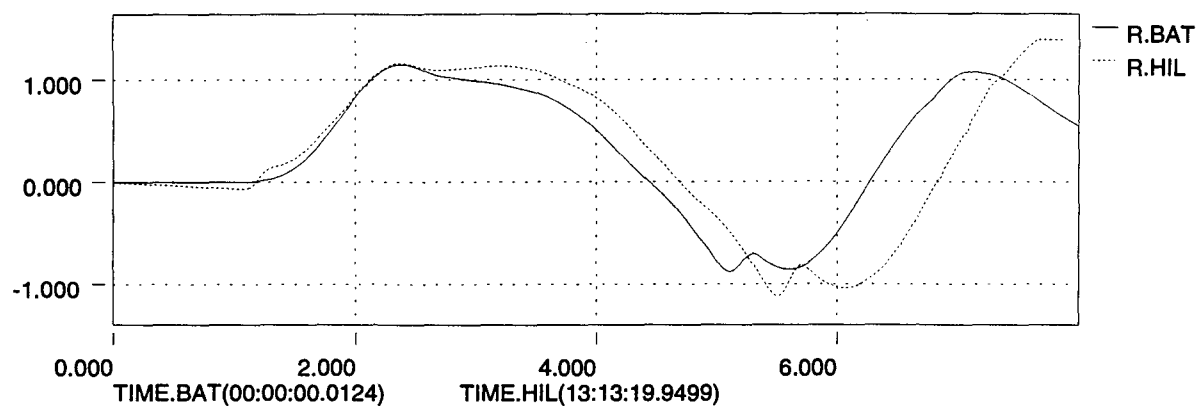
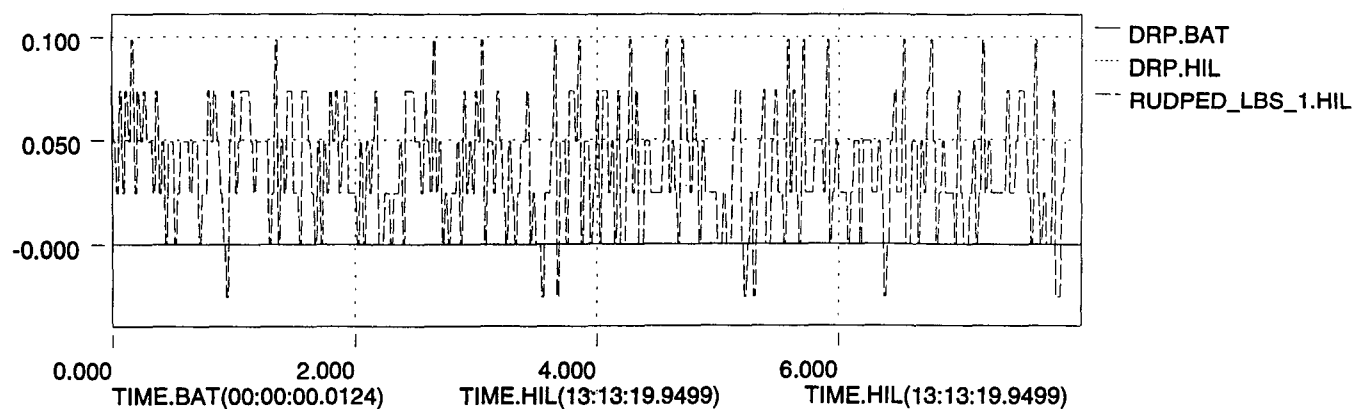
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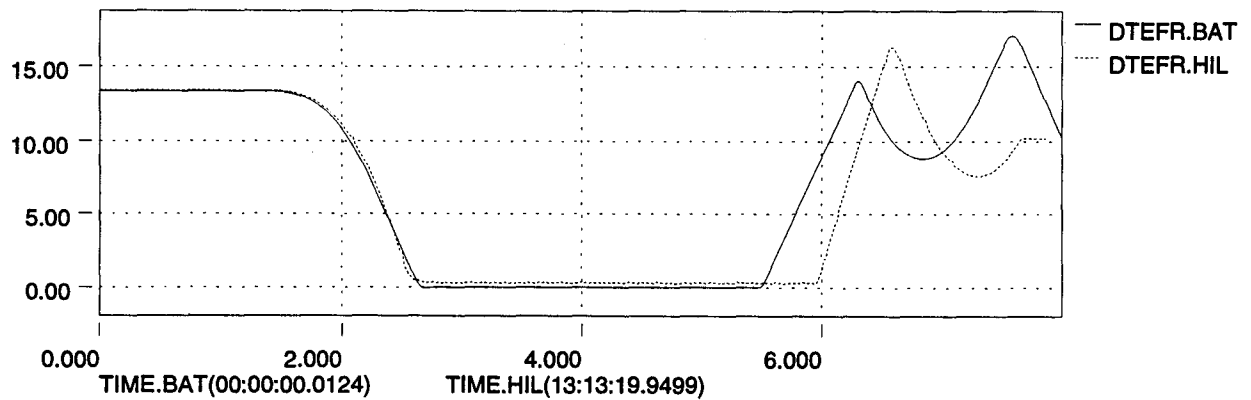
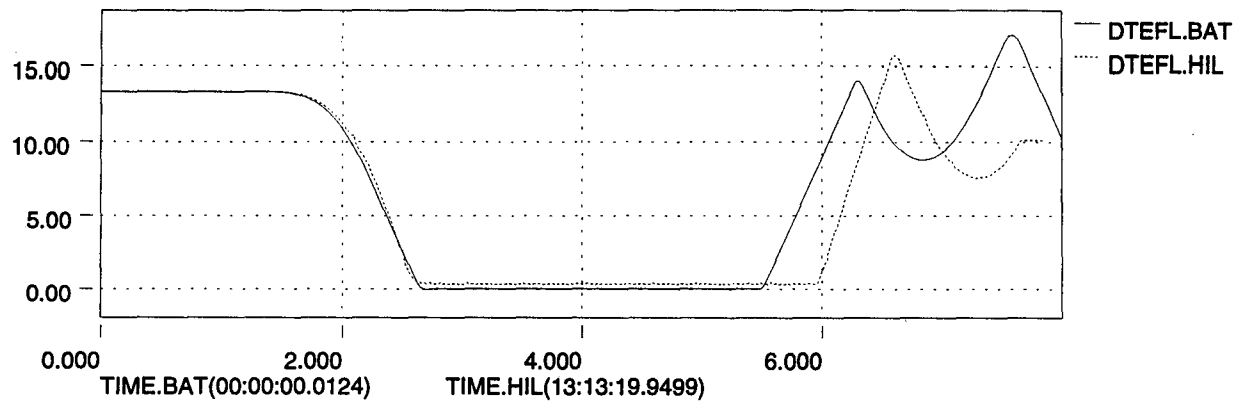
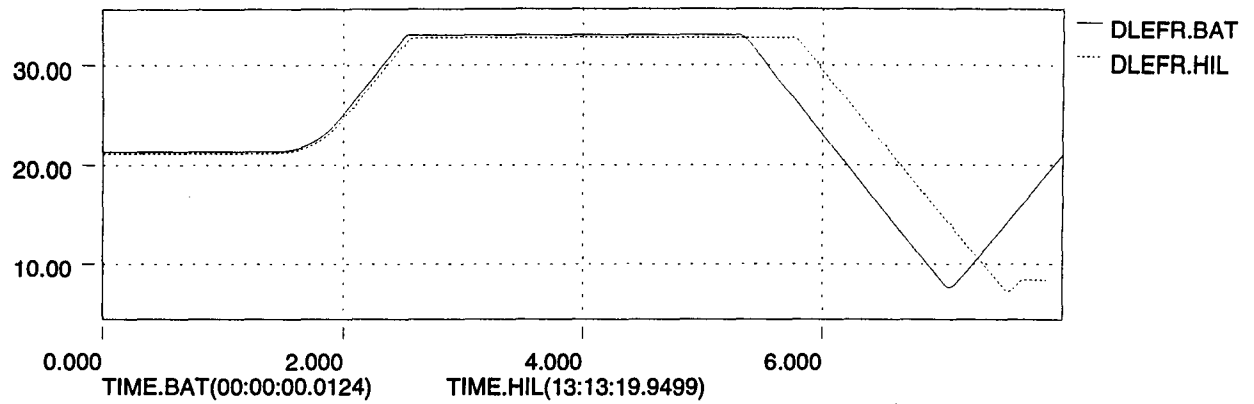
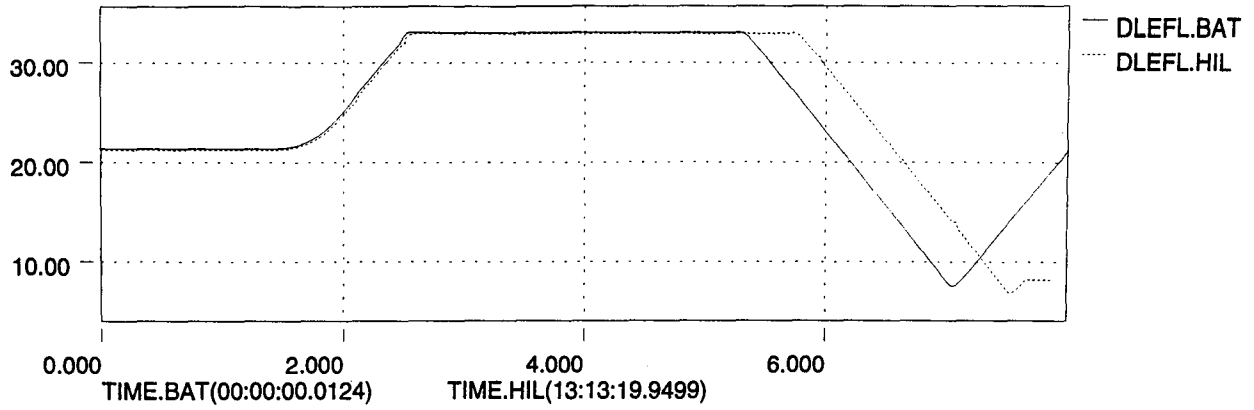
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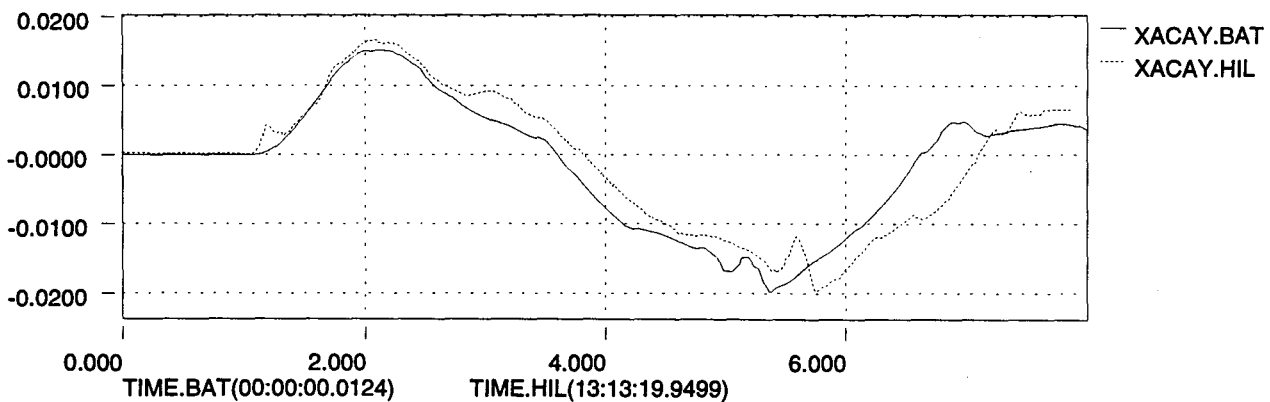
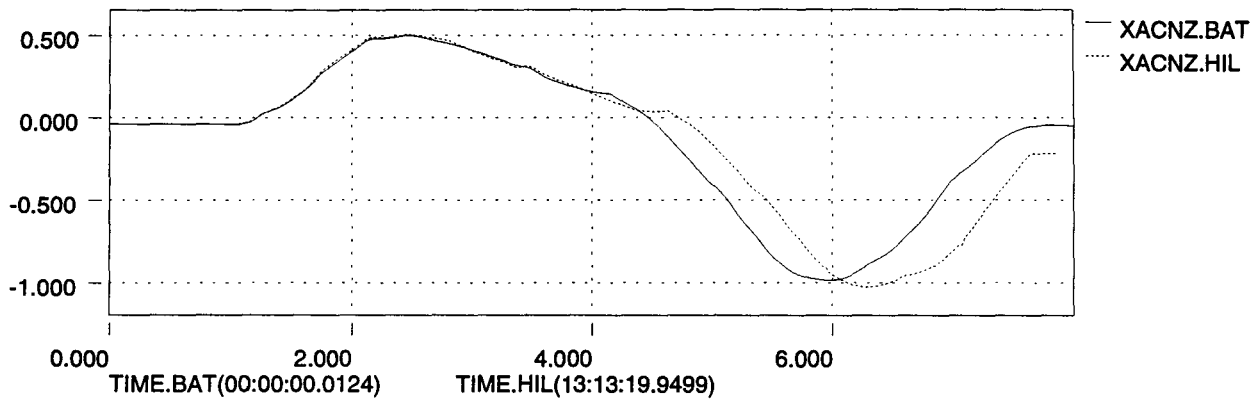
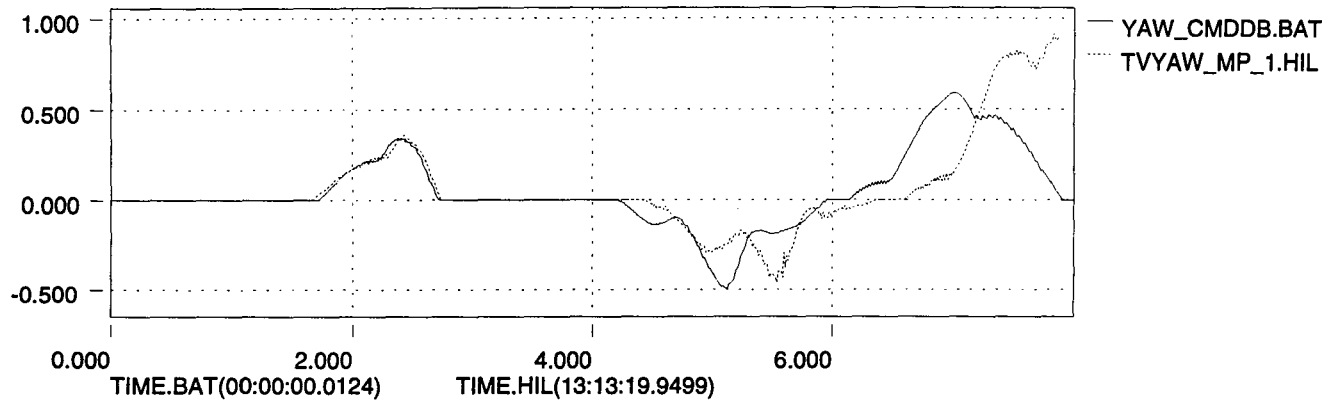
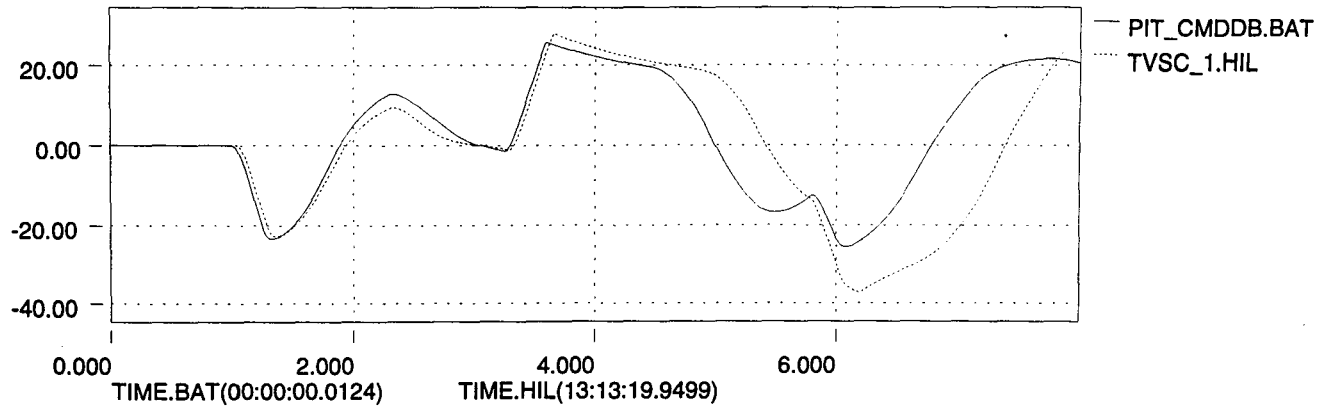
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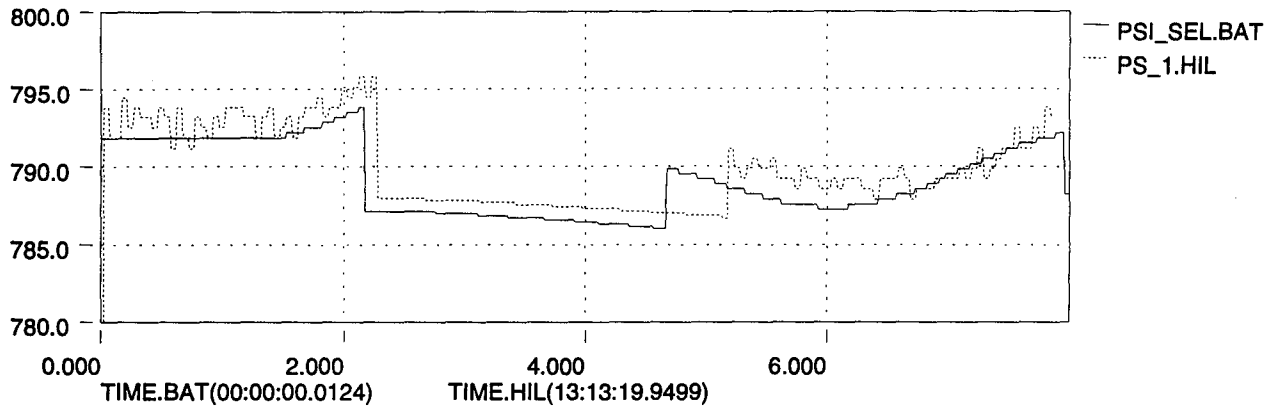
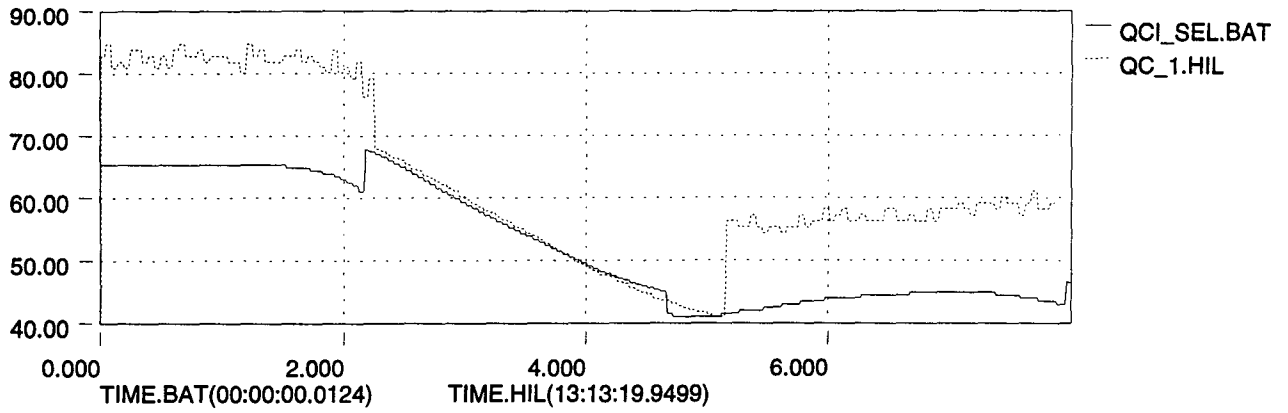
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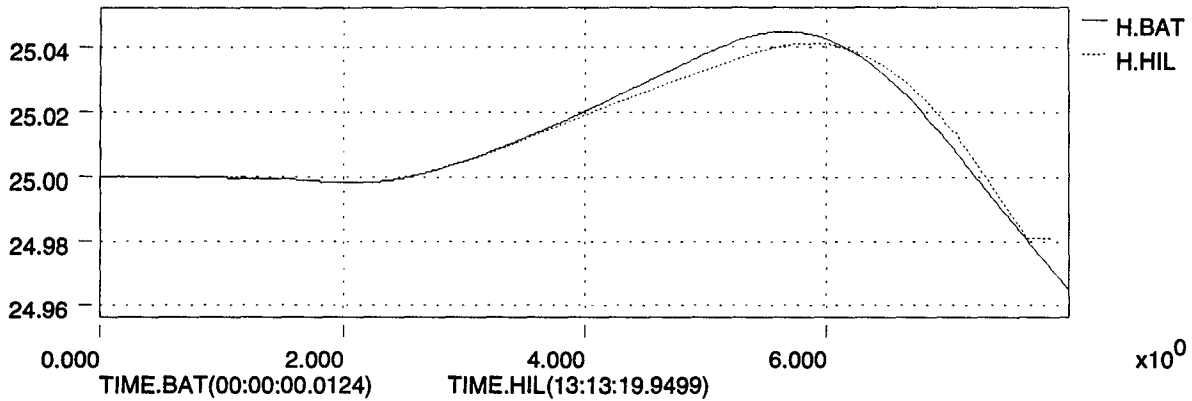


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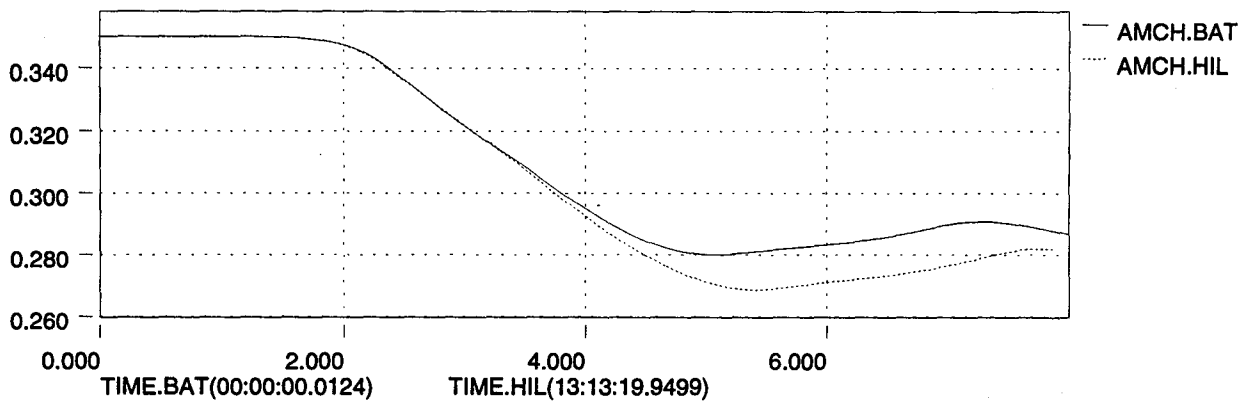
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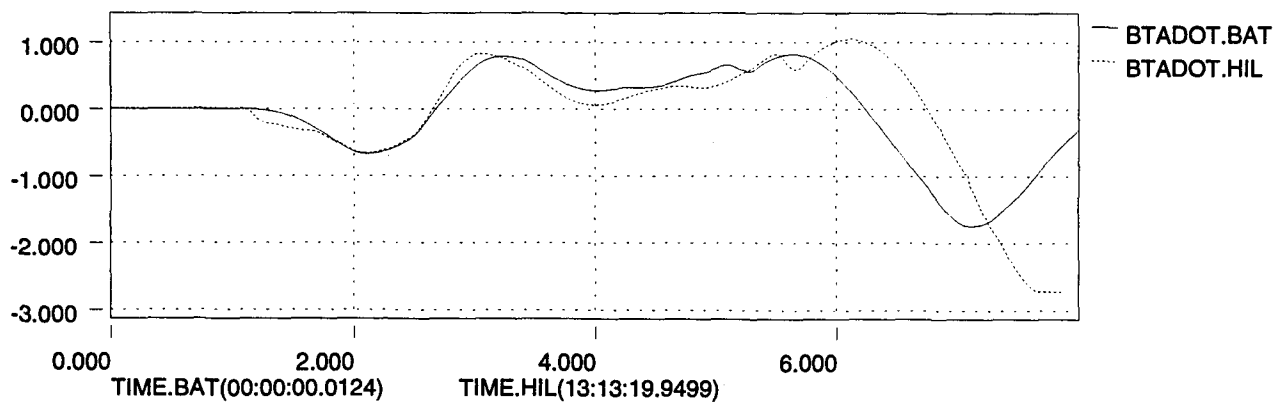
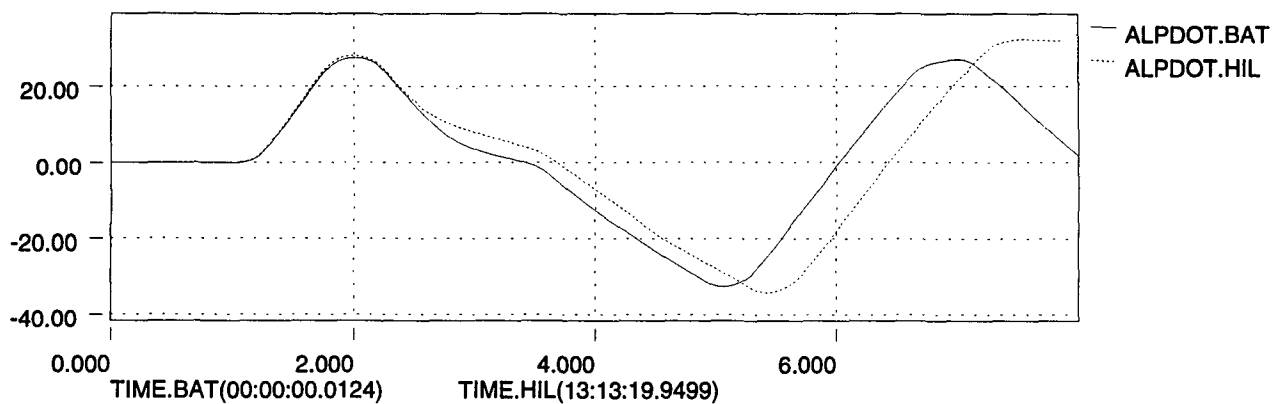
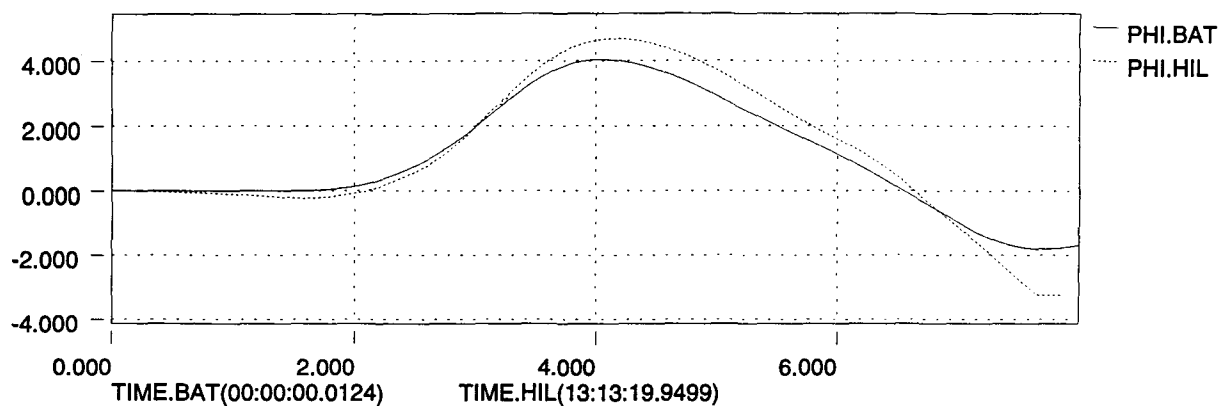
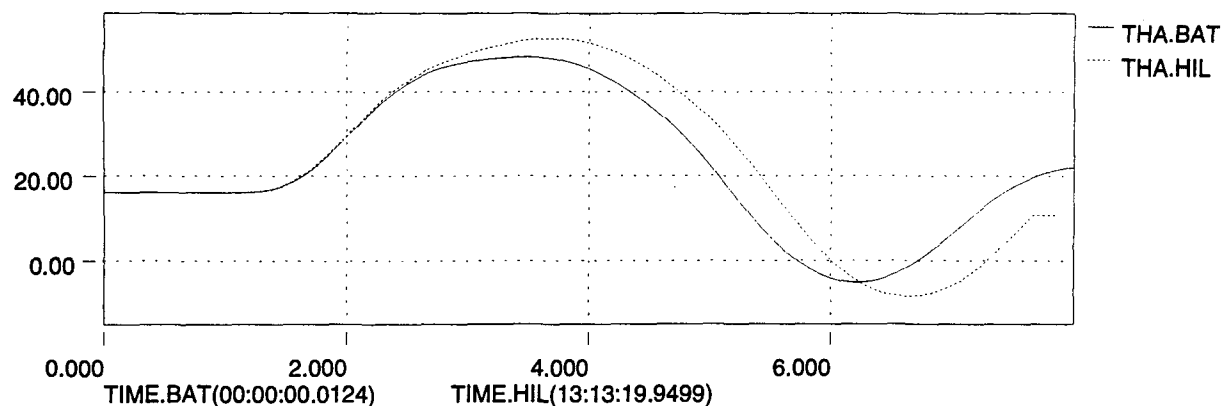


$\times 10^0$



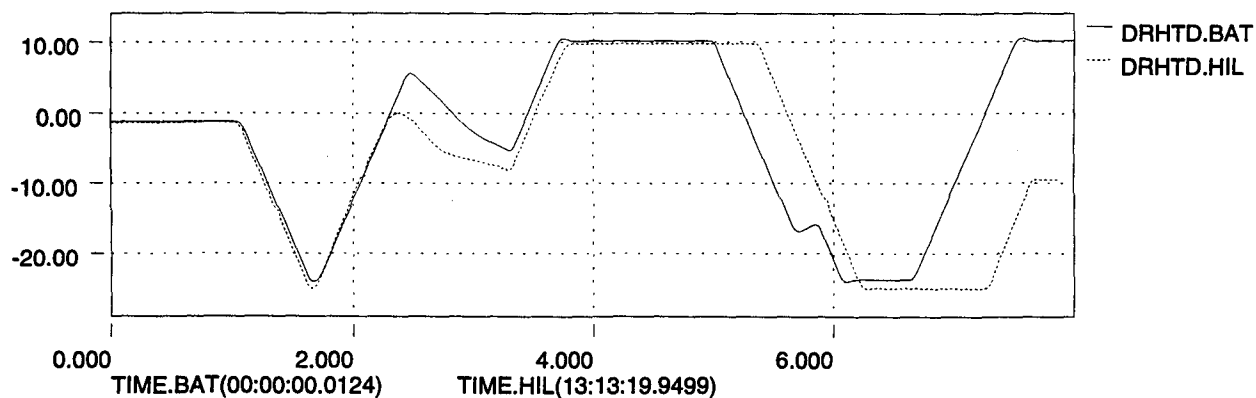
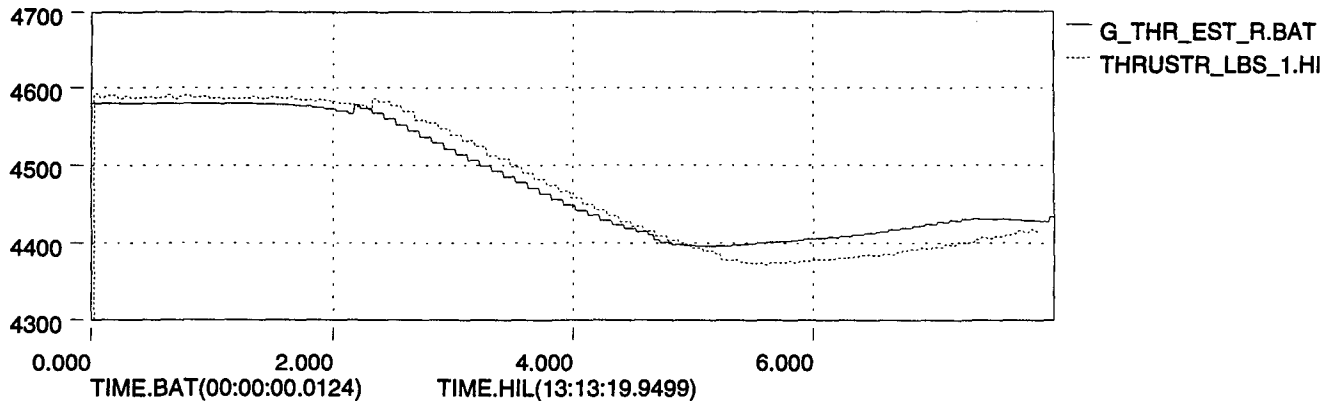
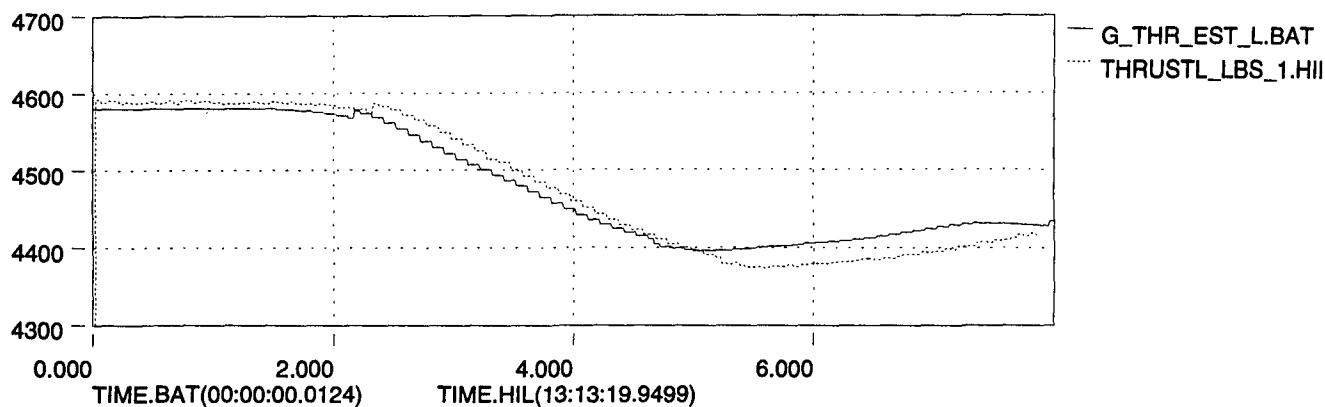
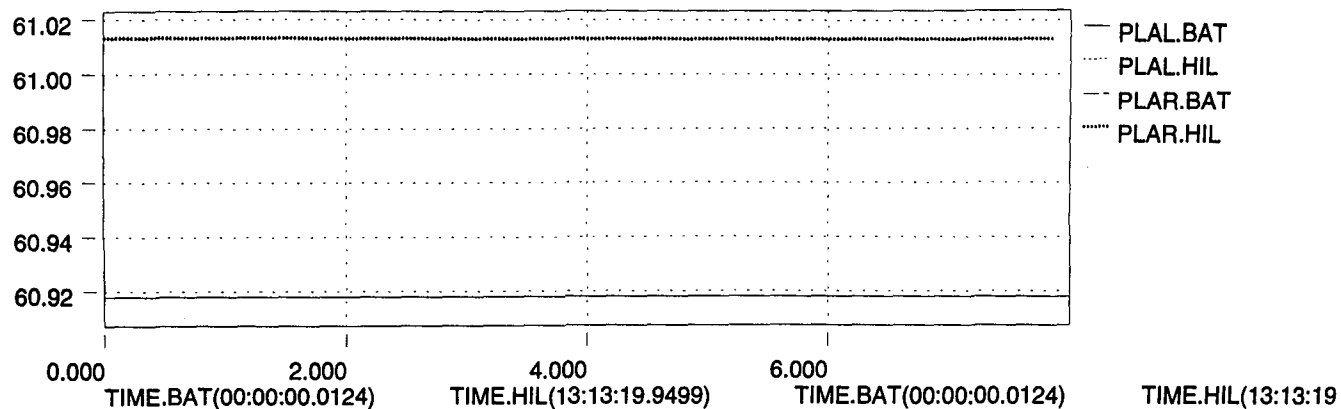
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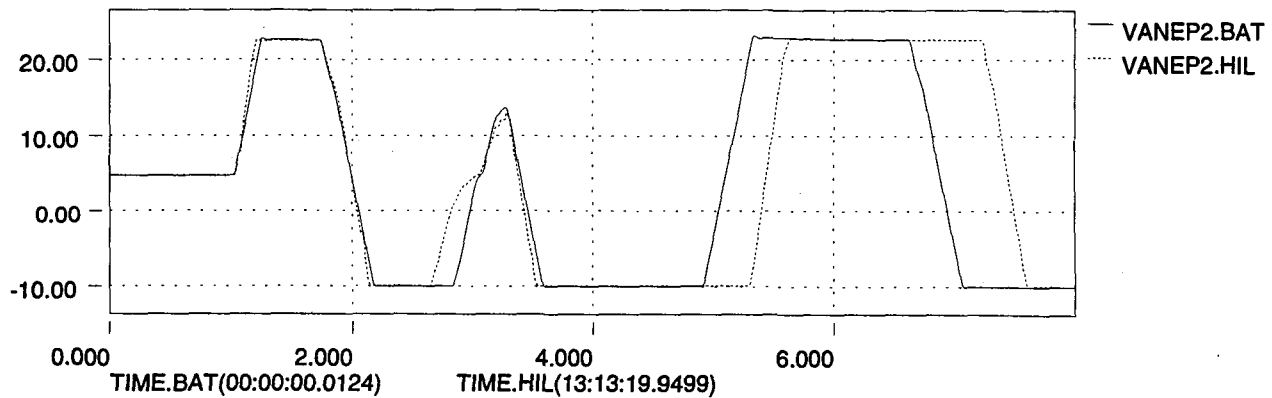
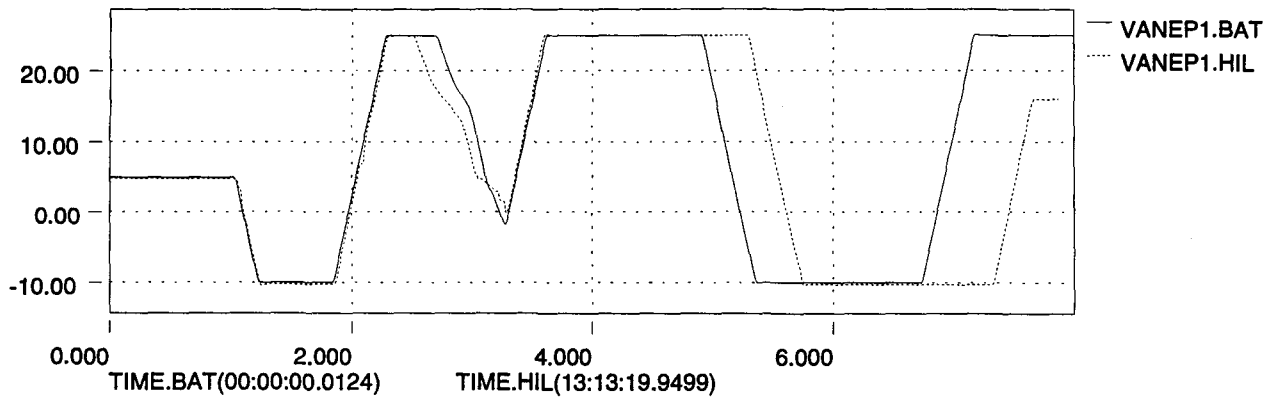
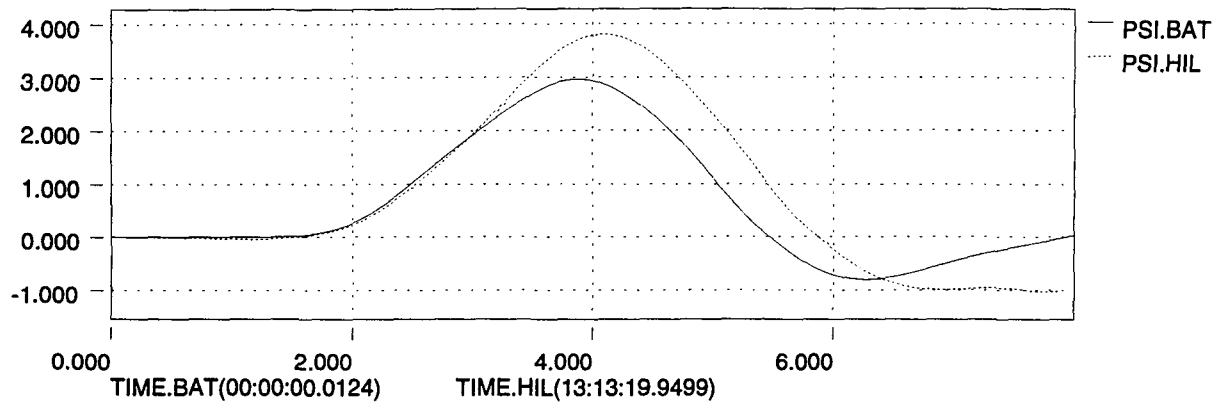
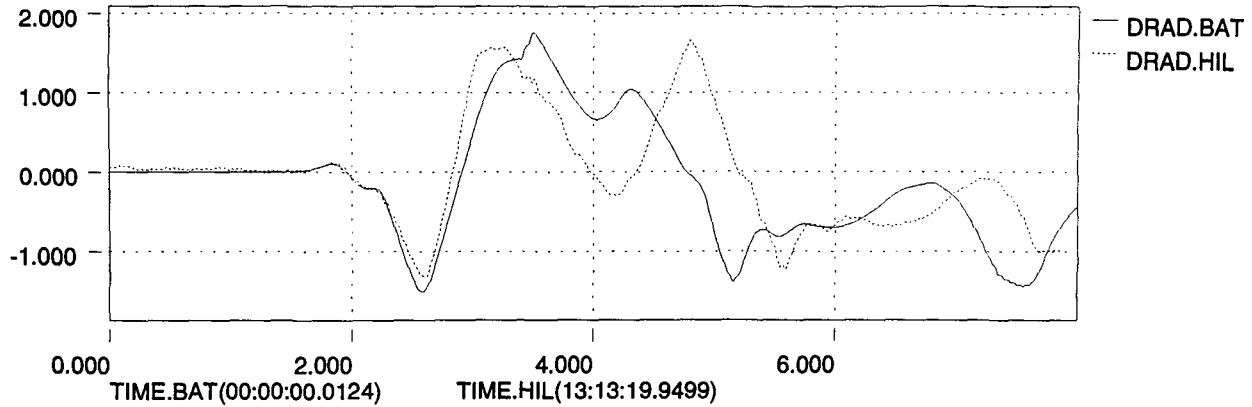
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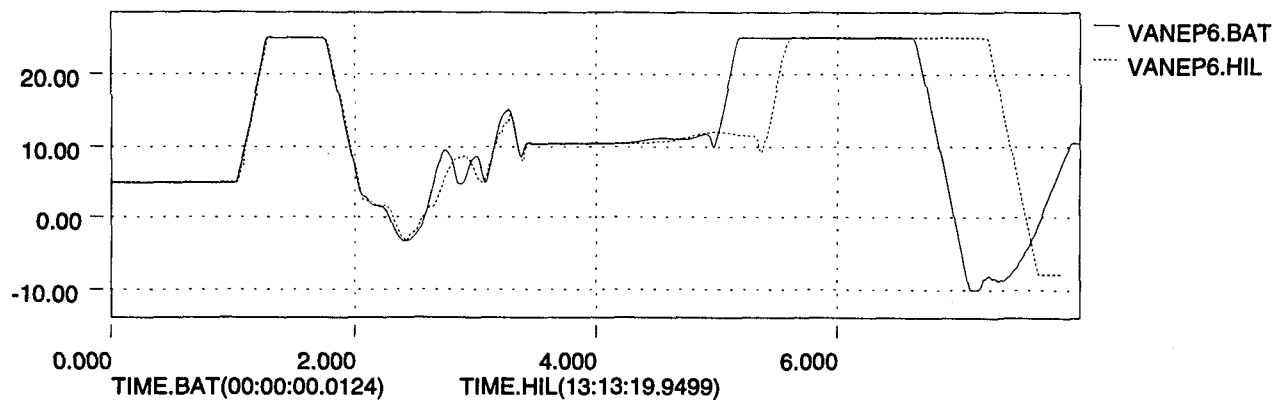
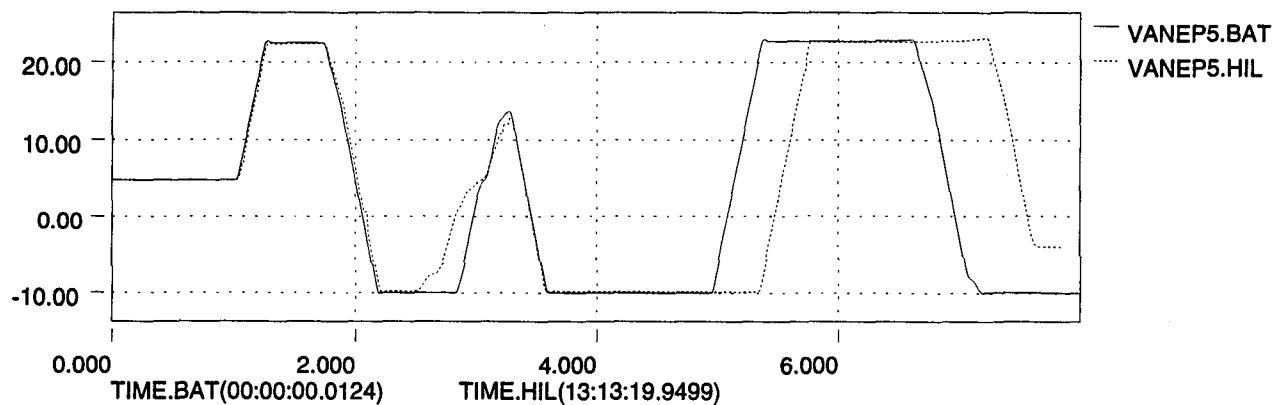
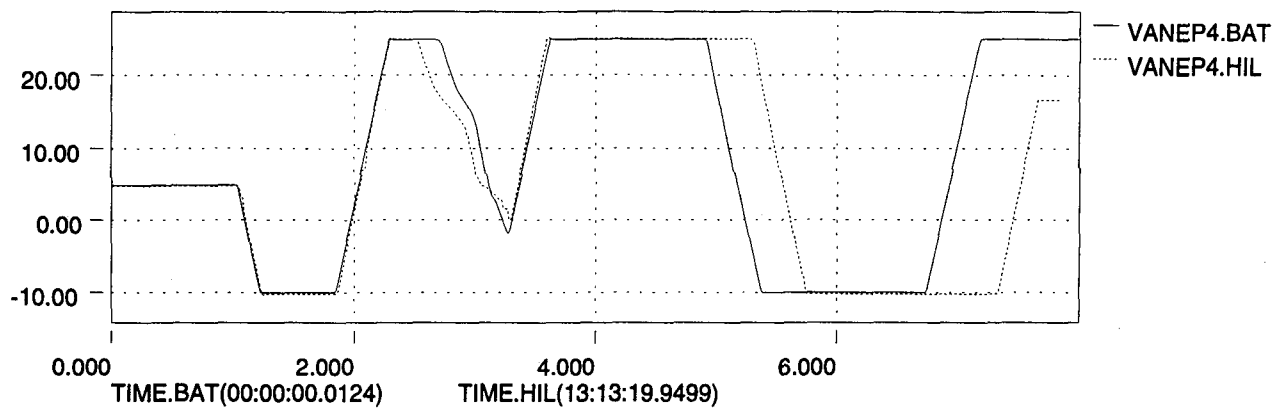
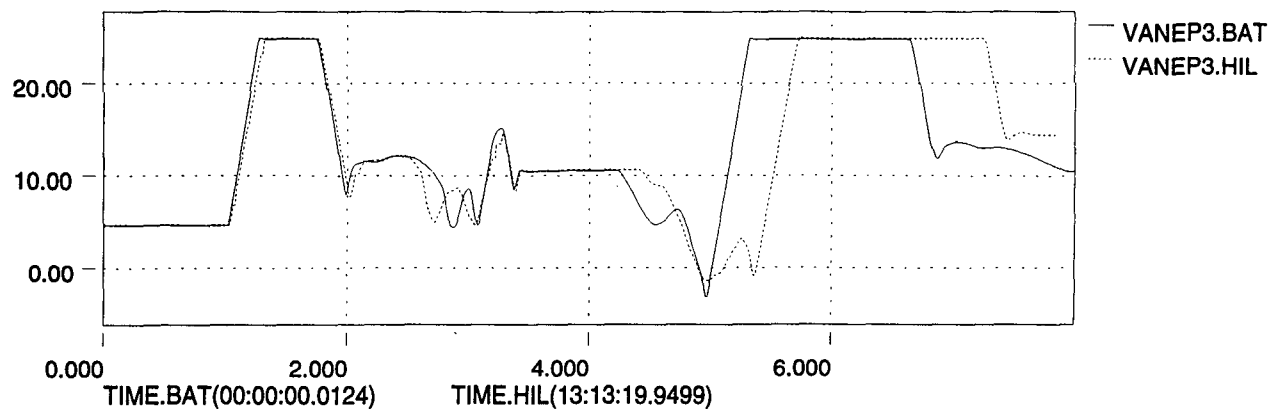
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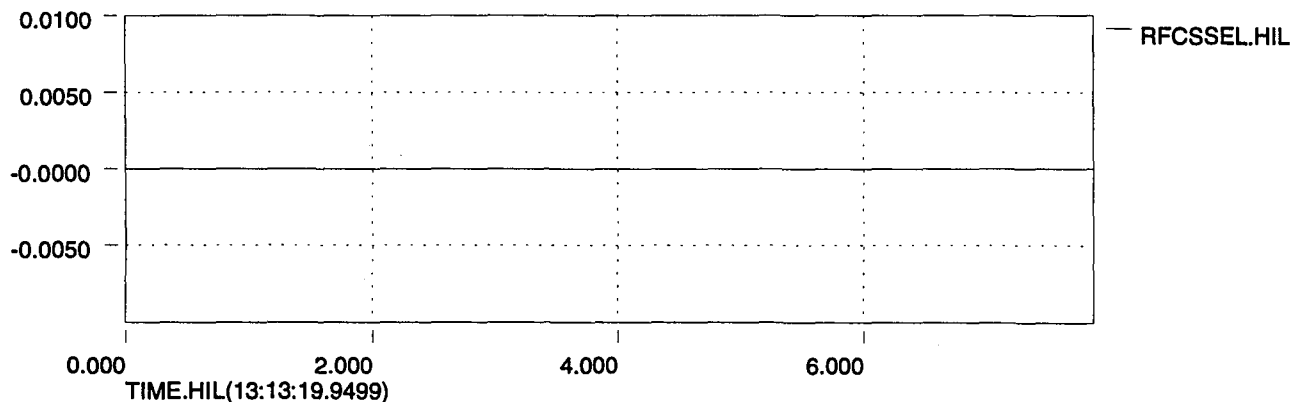
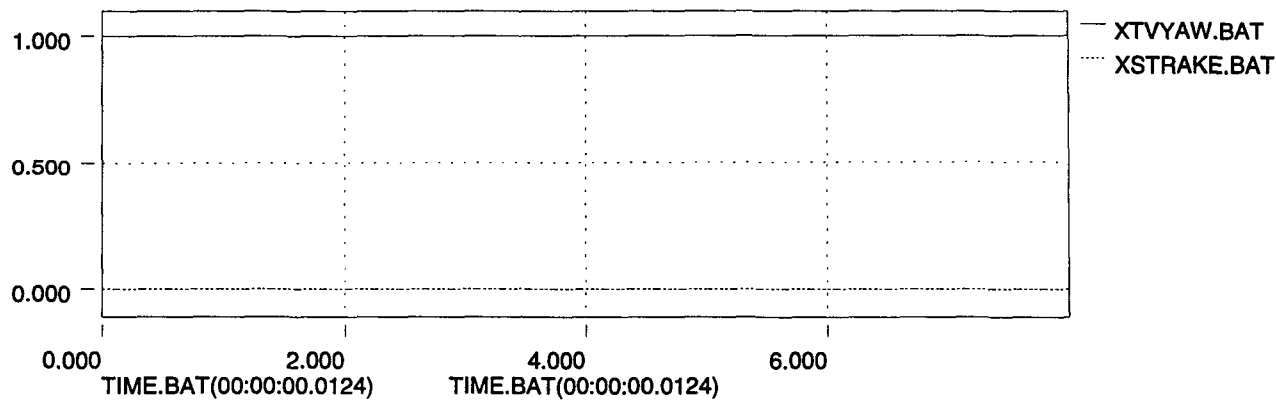
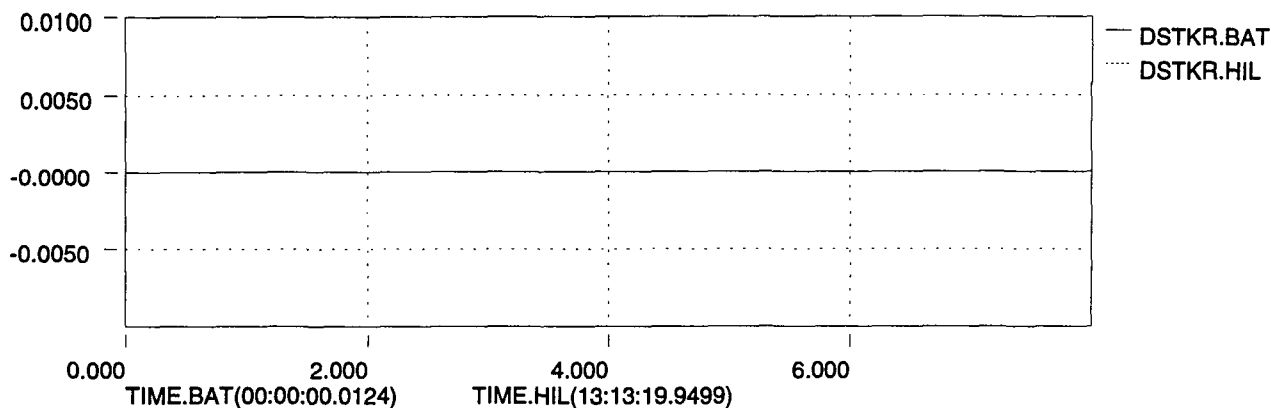
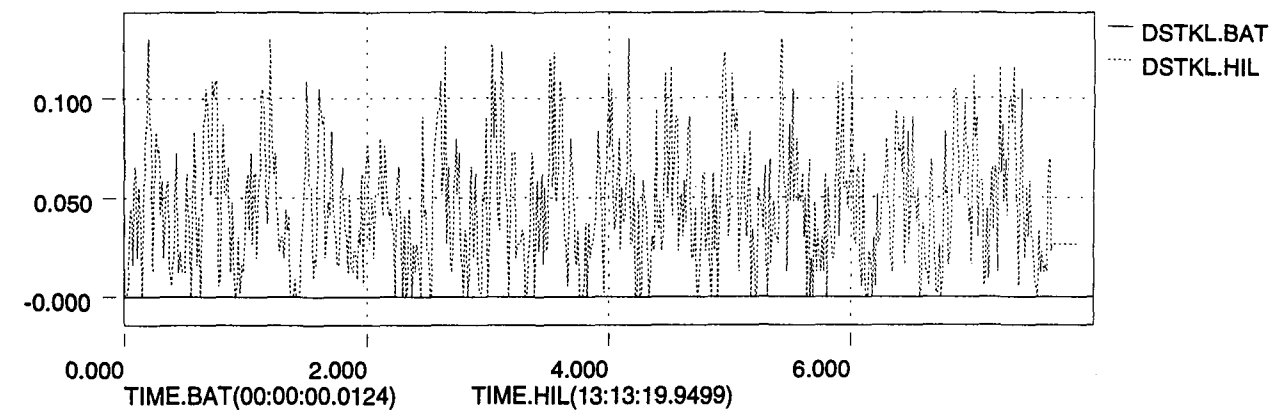


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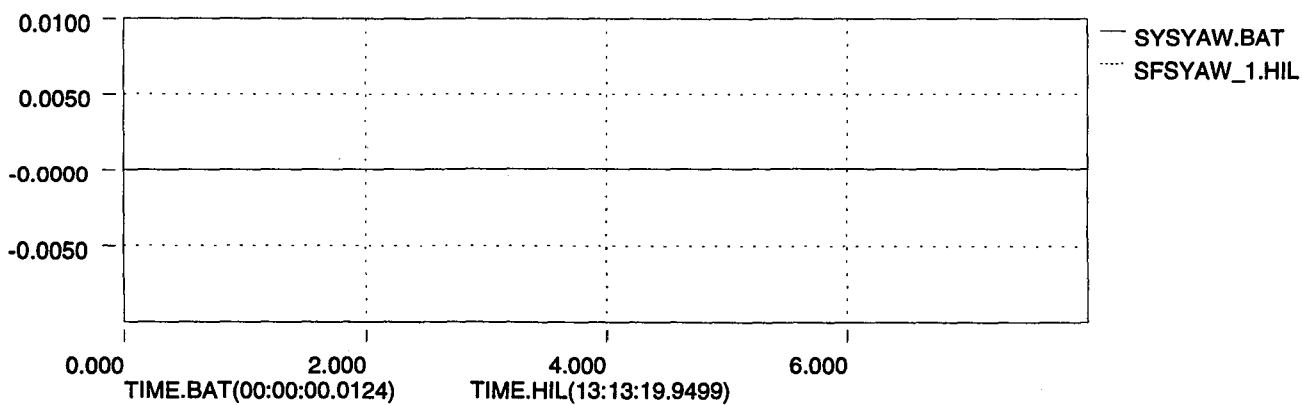
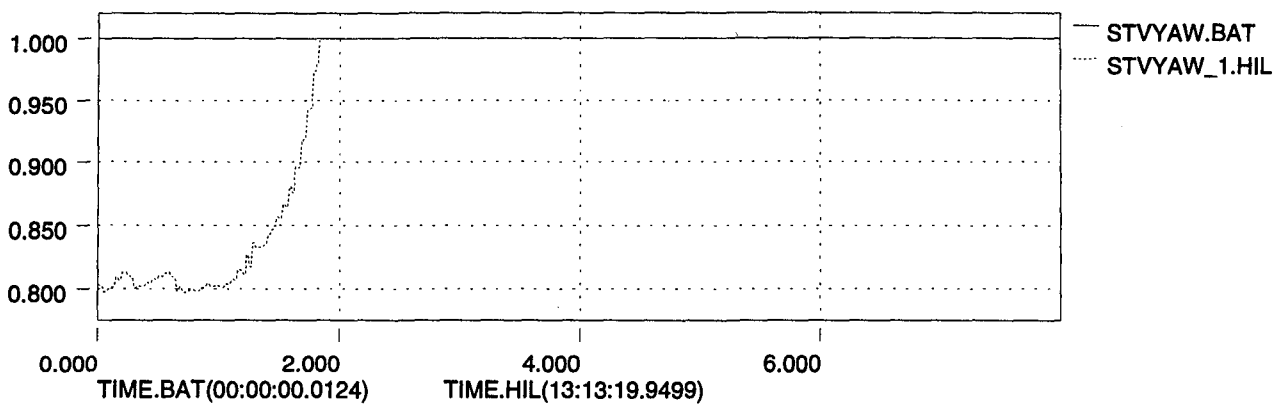
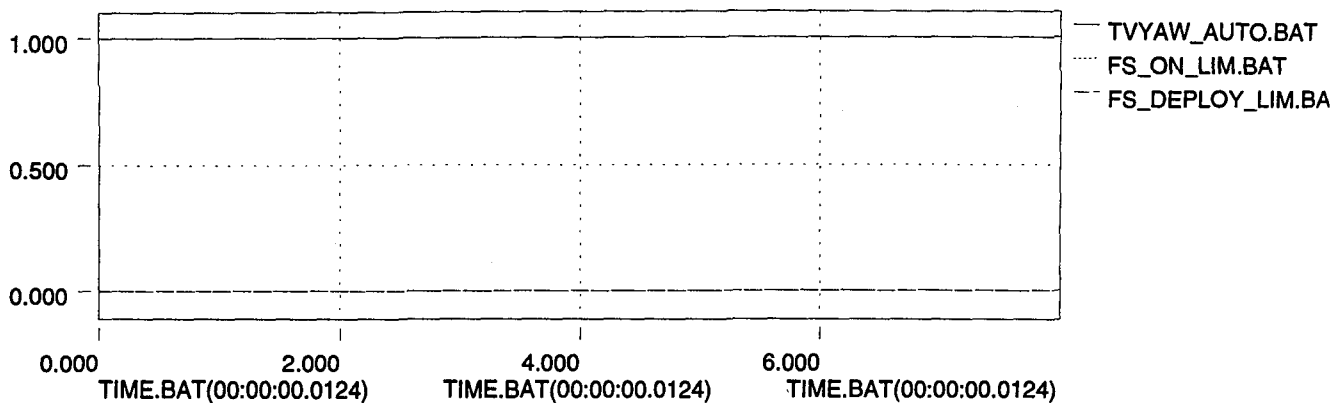
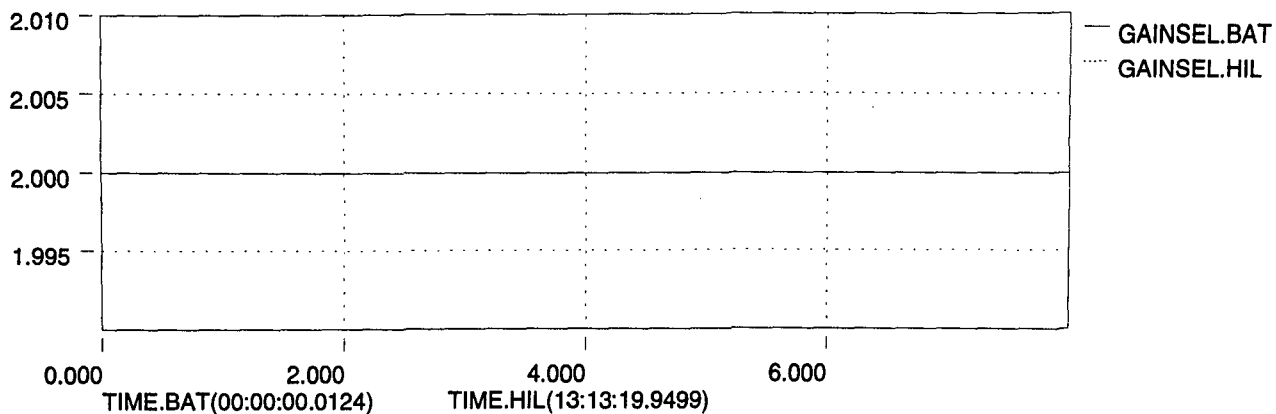


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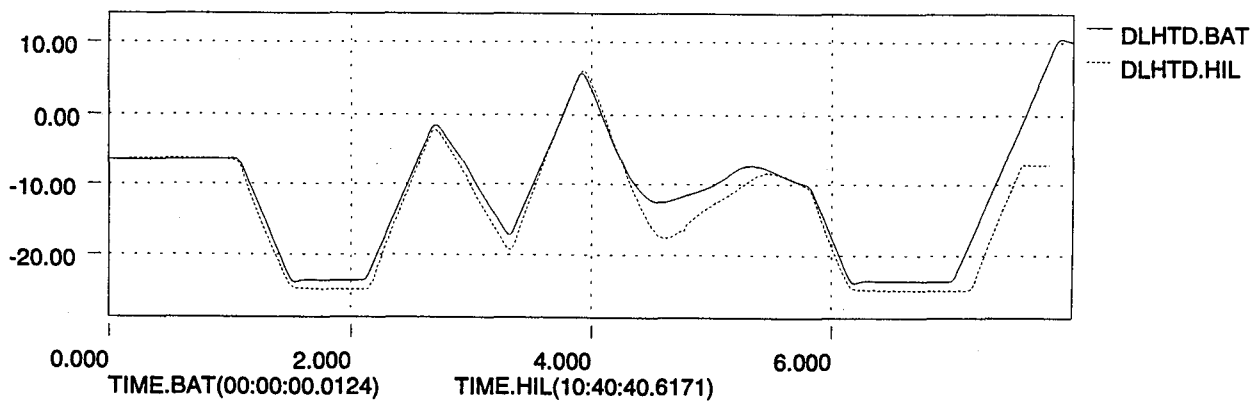
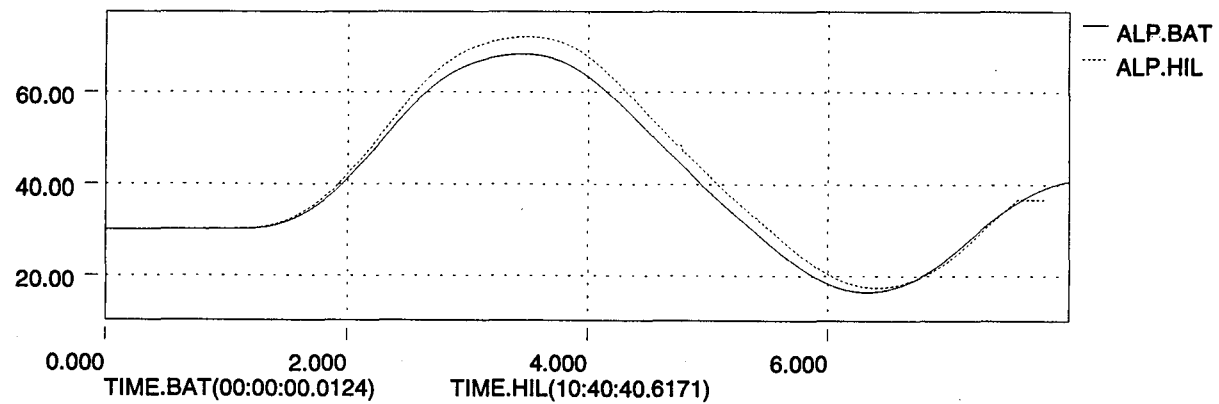
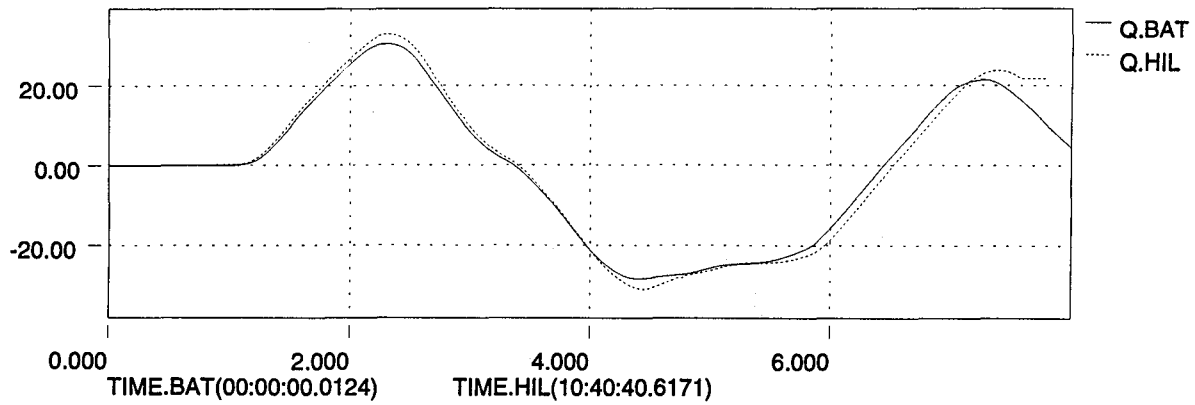
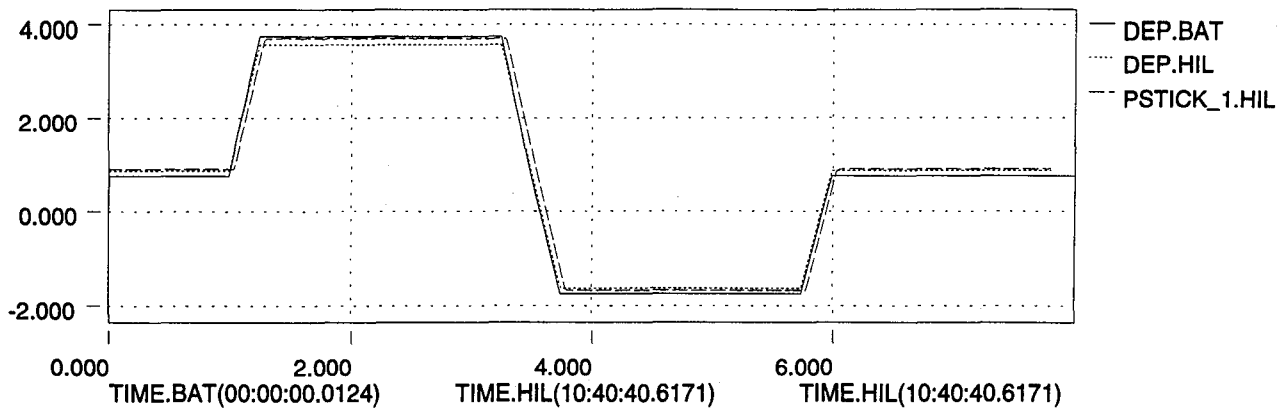
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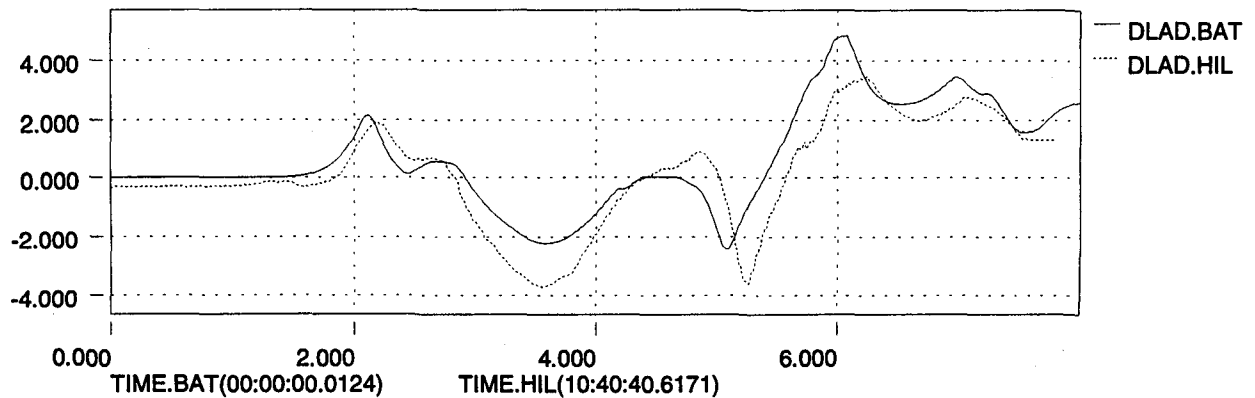
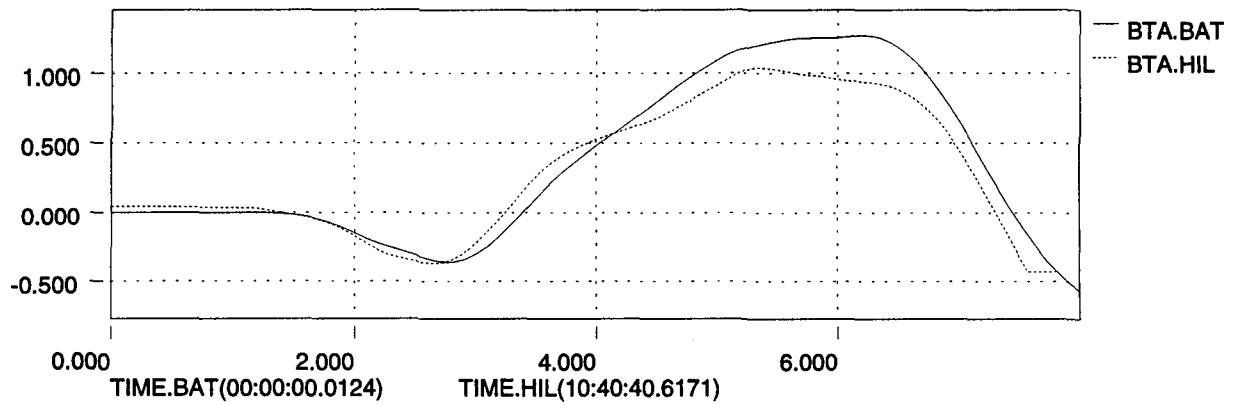
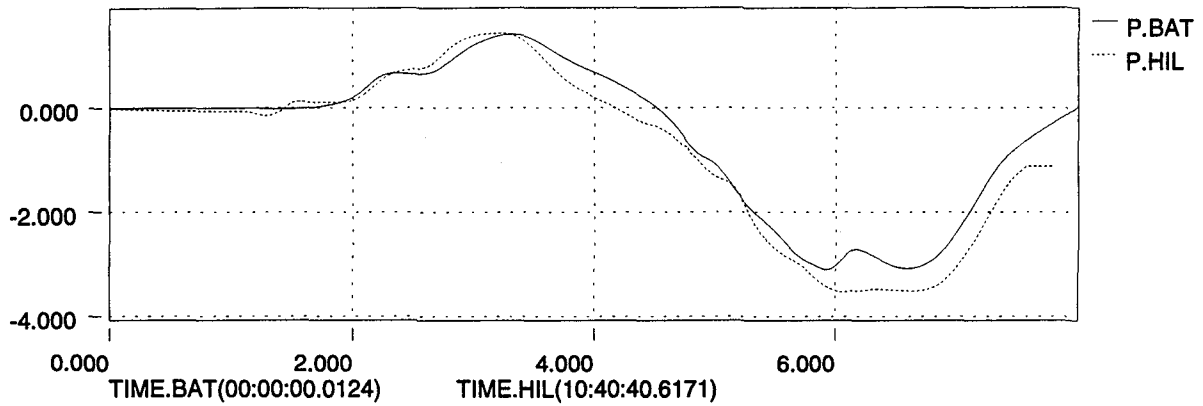
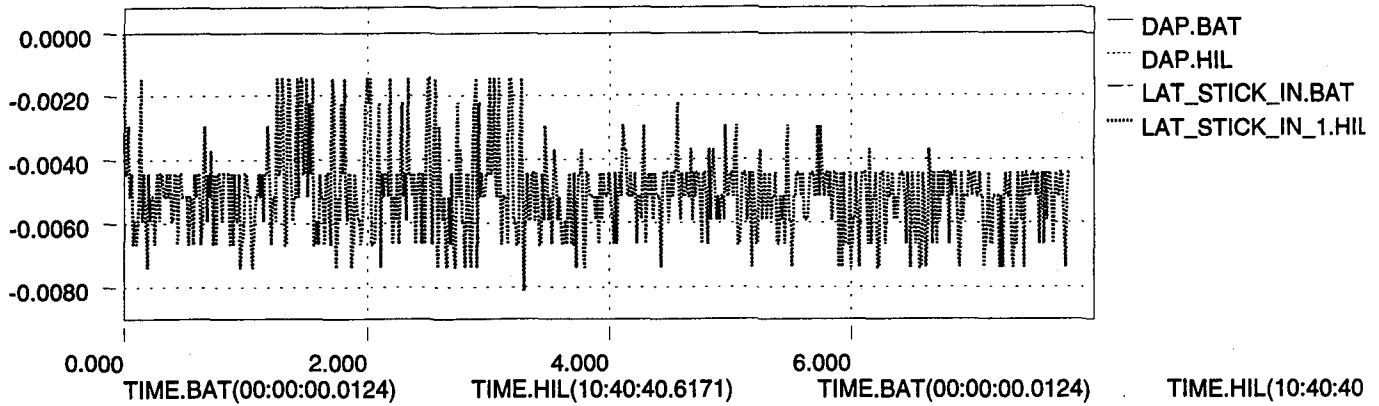
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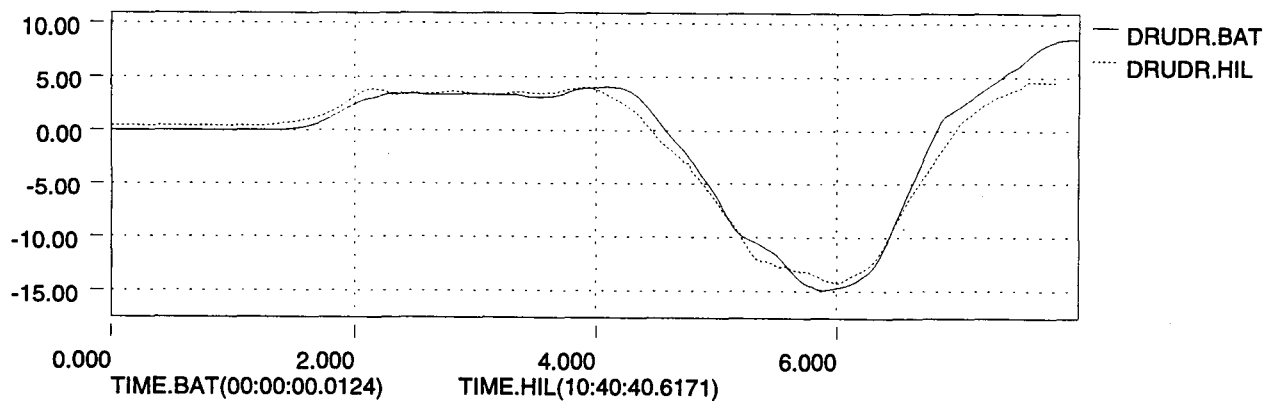
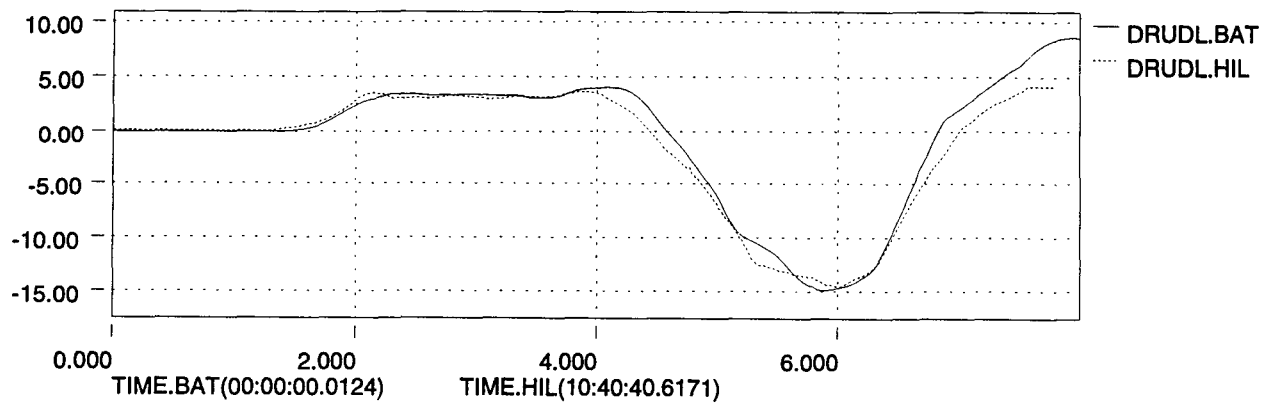
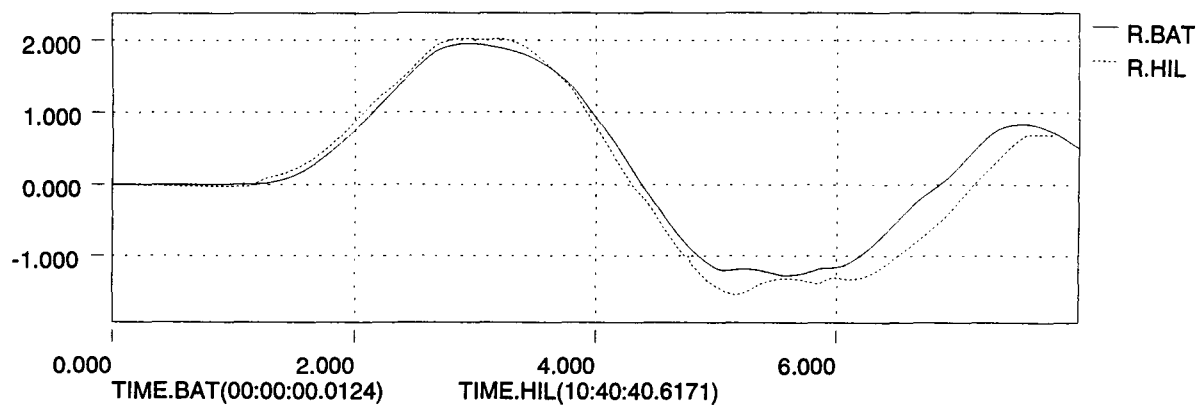
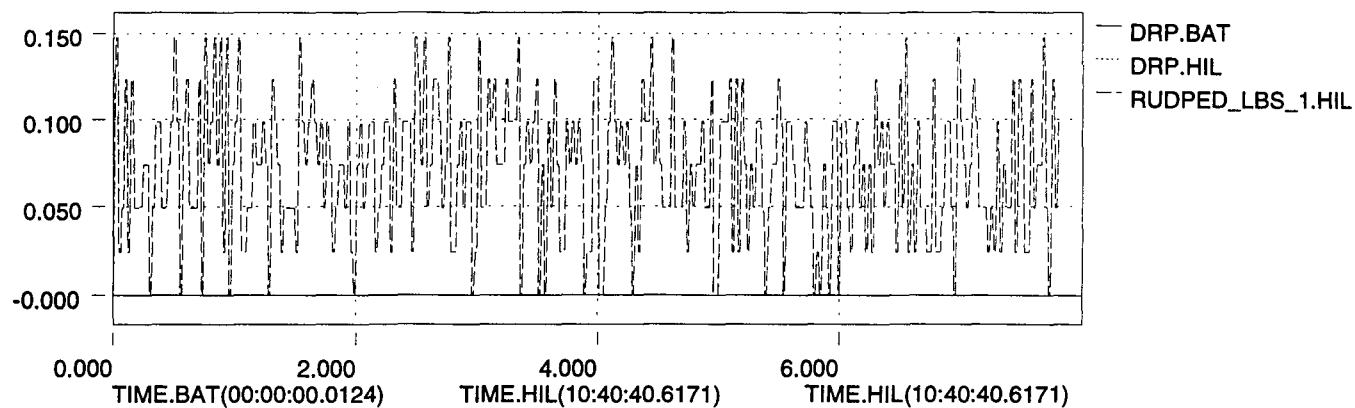
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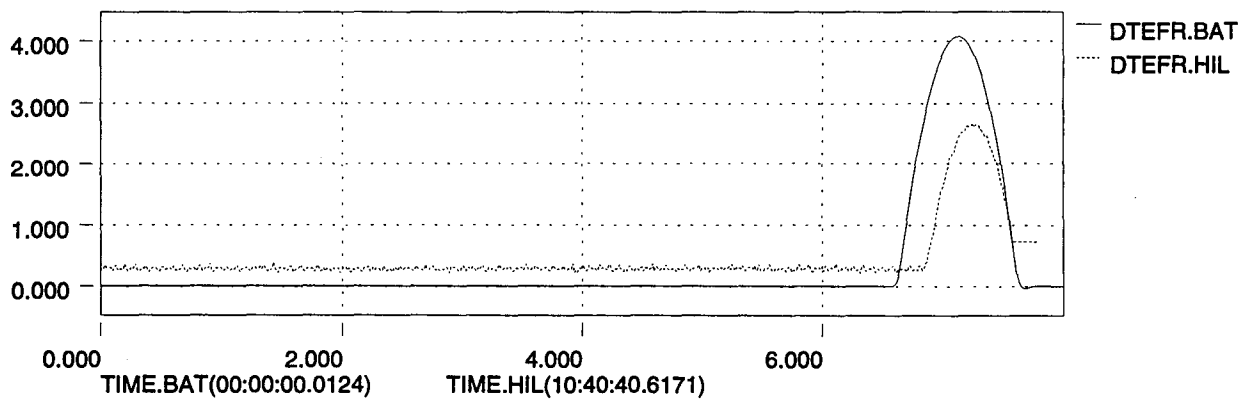
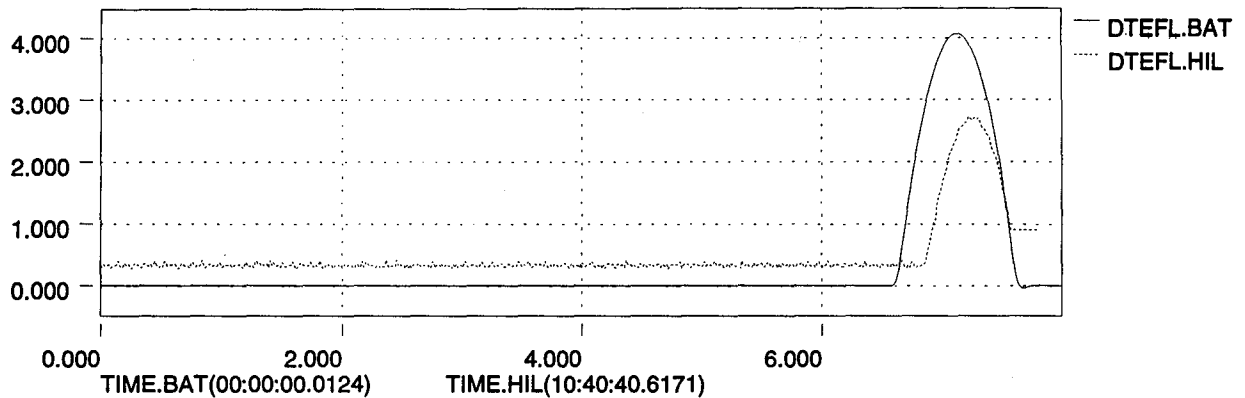
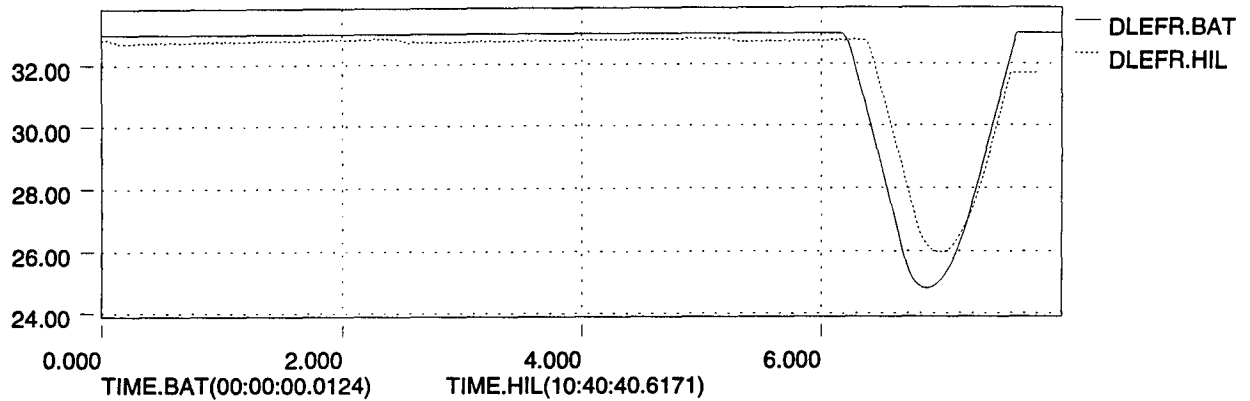
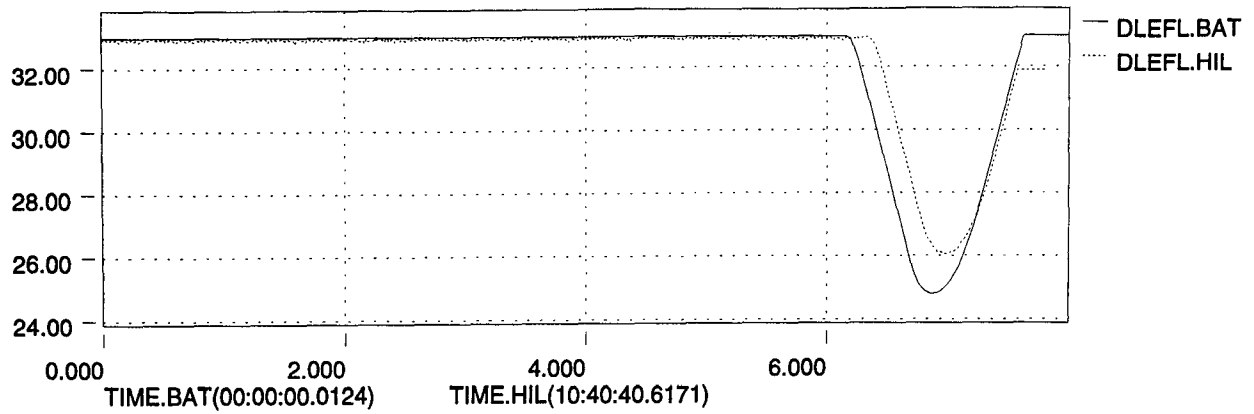
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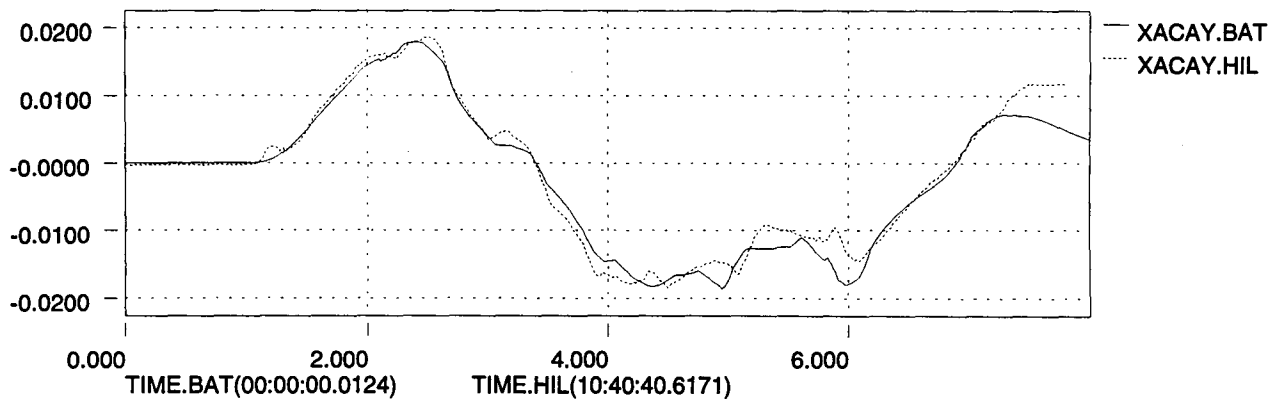
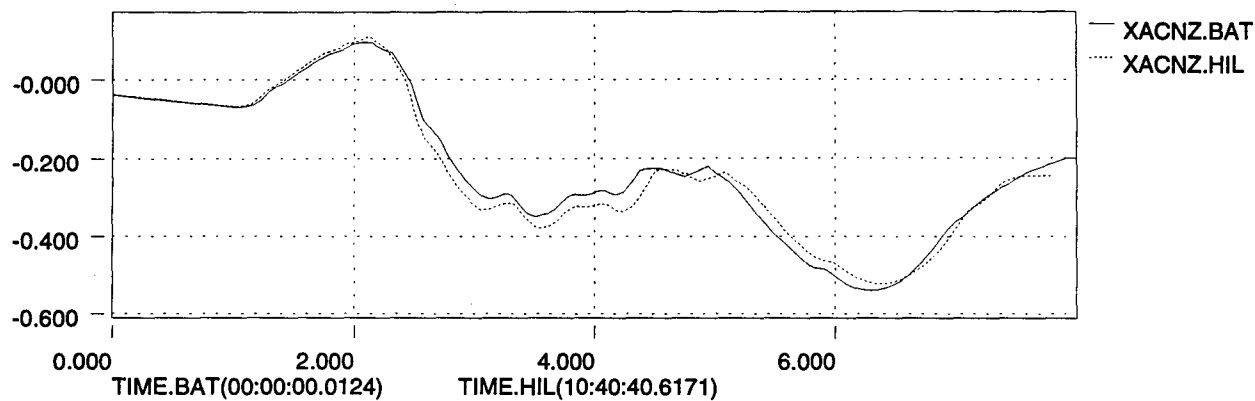
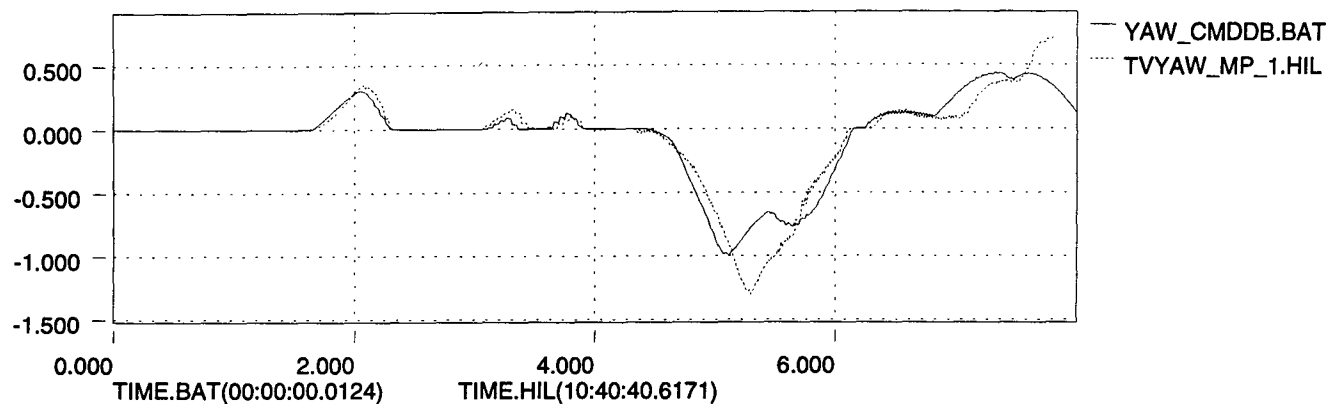
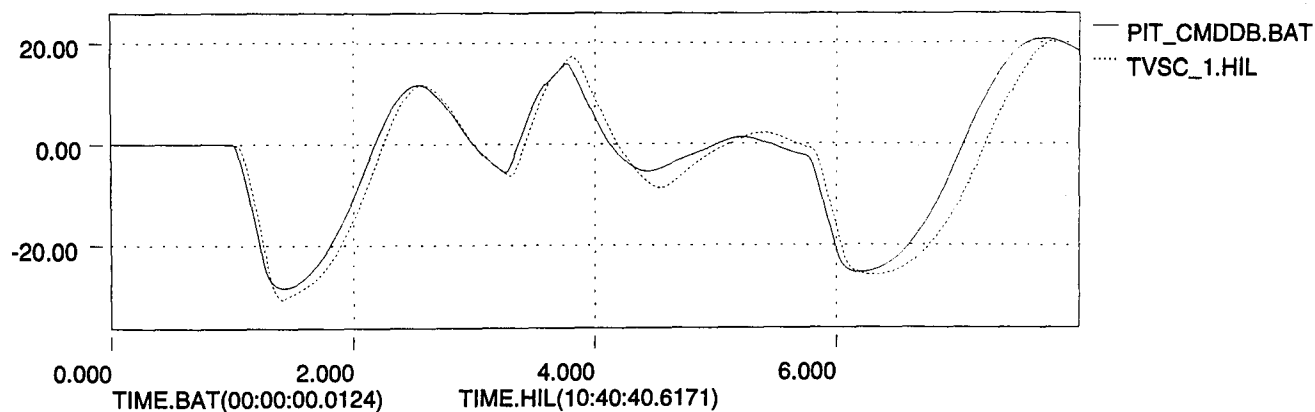
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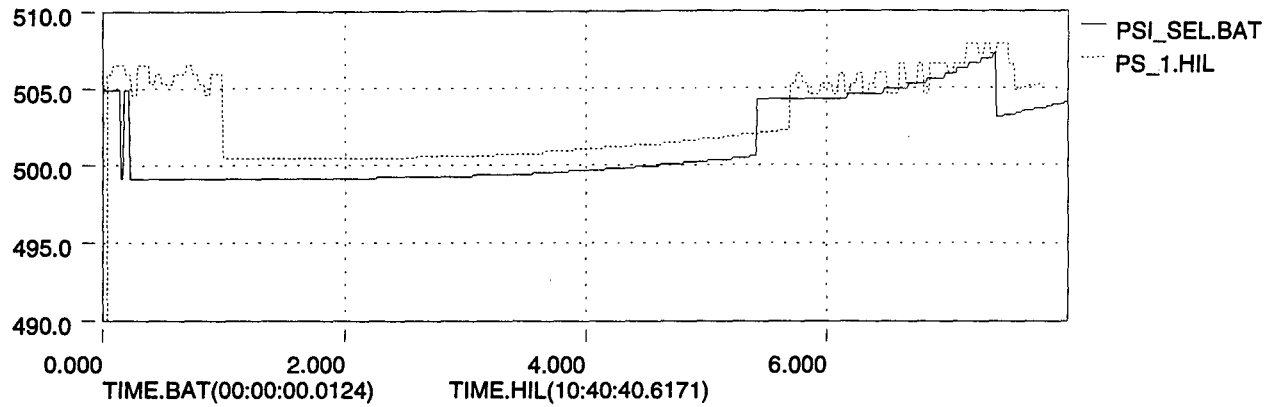
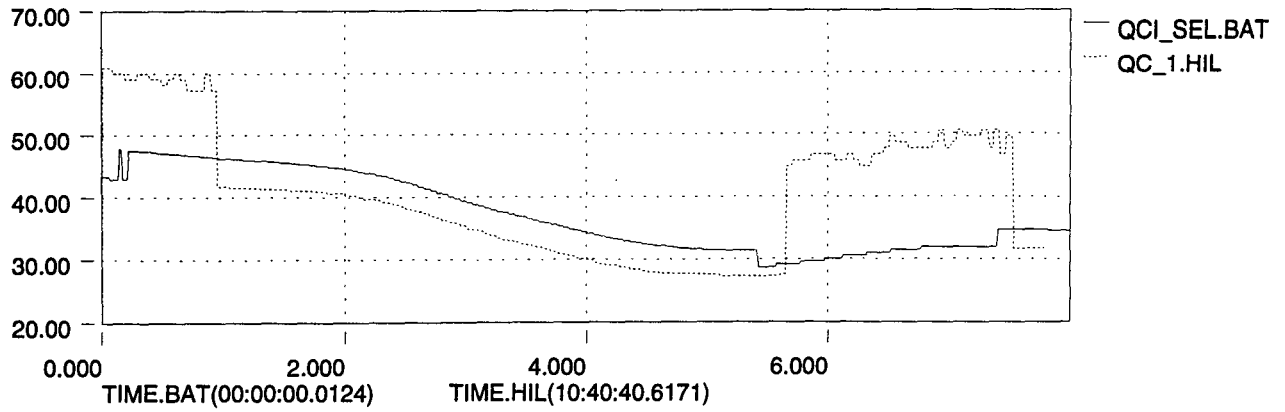
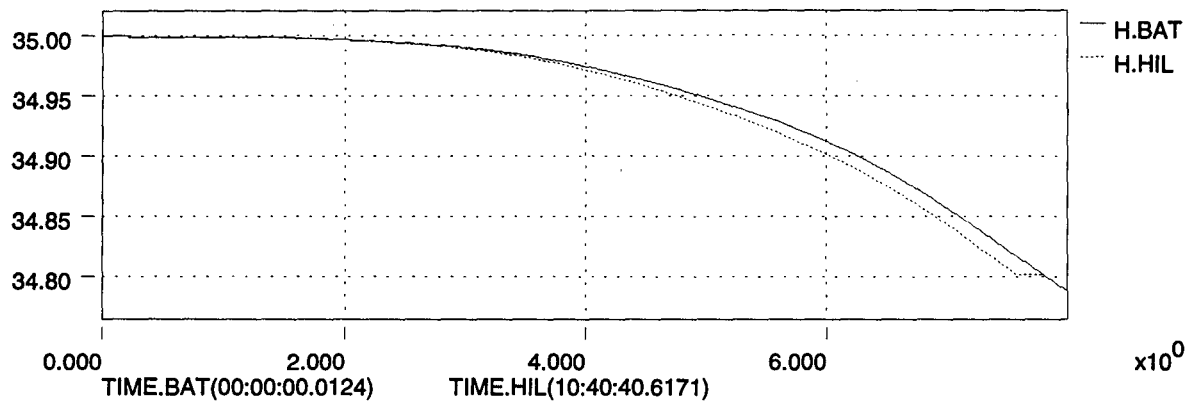
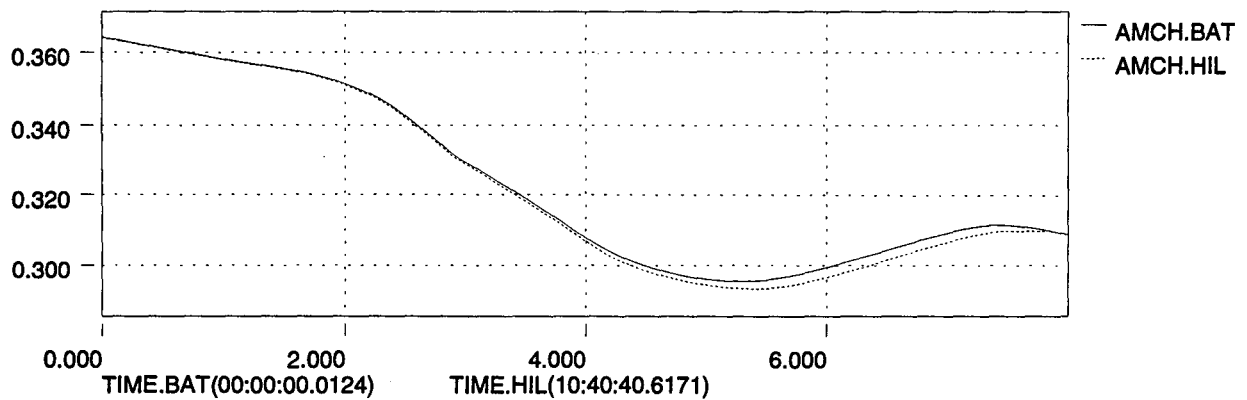


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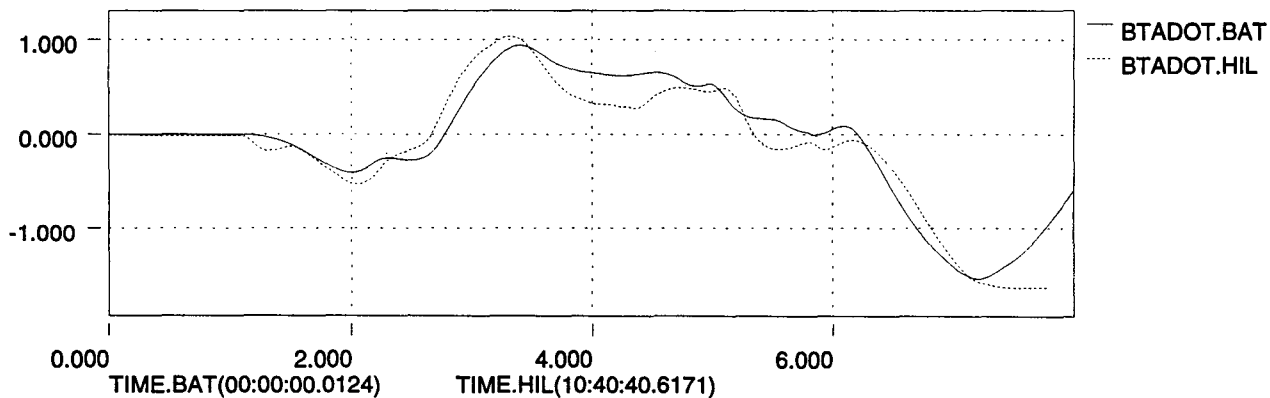
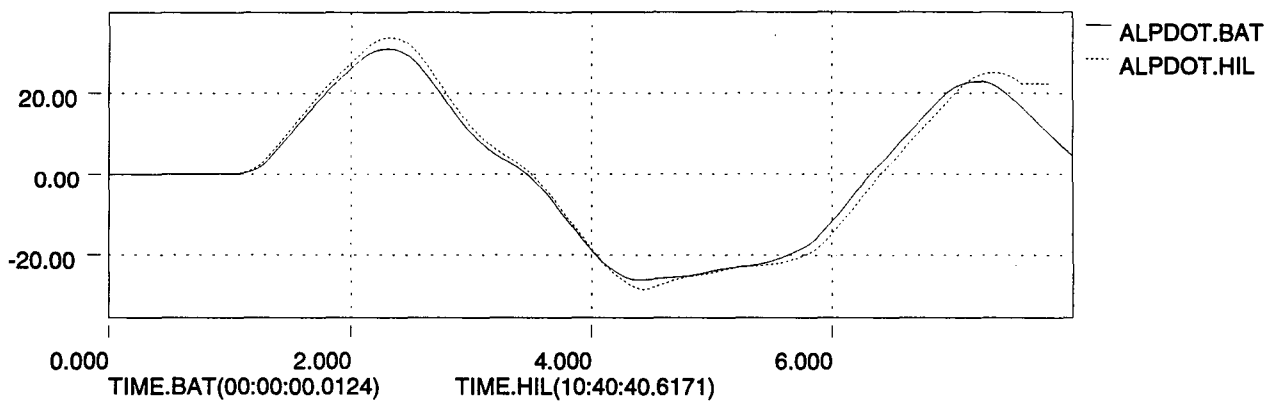
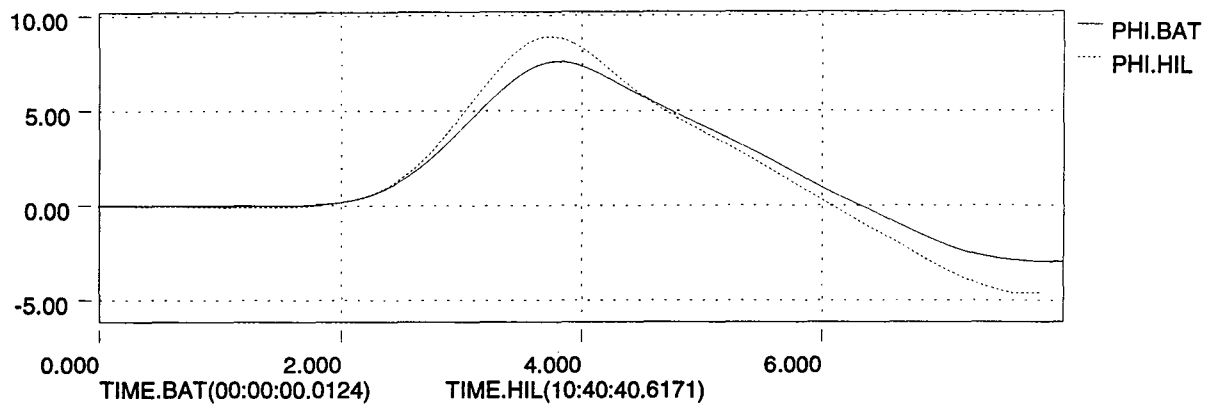
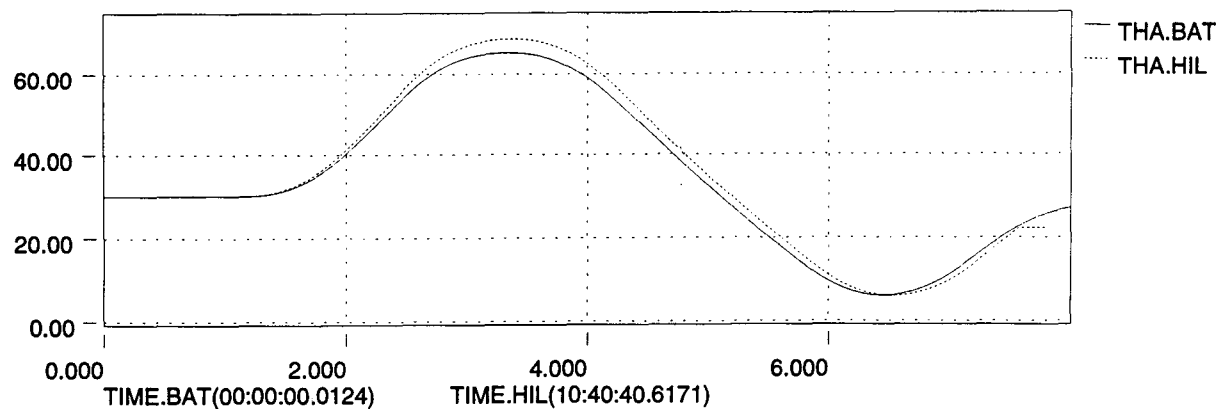


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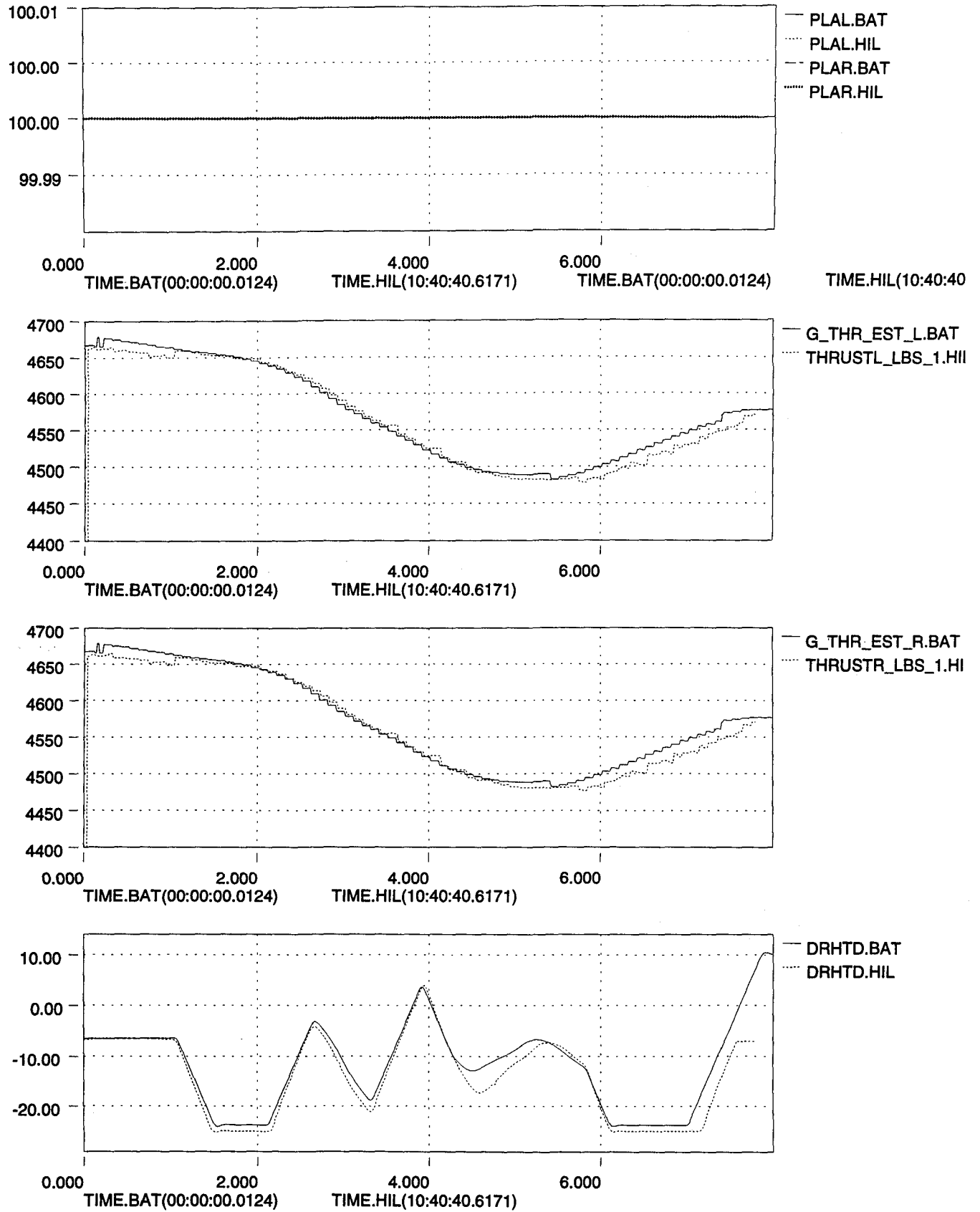
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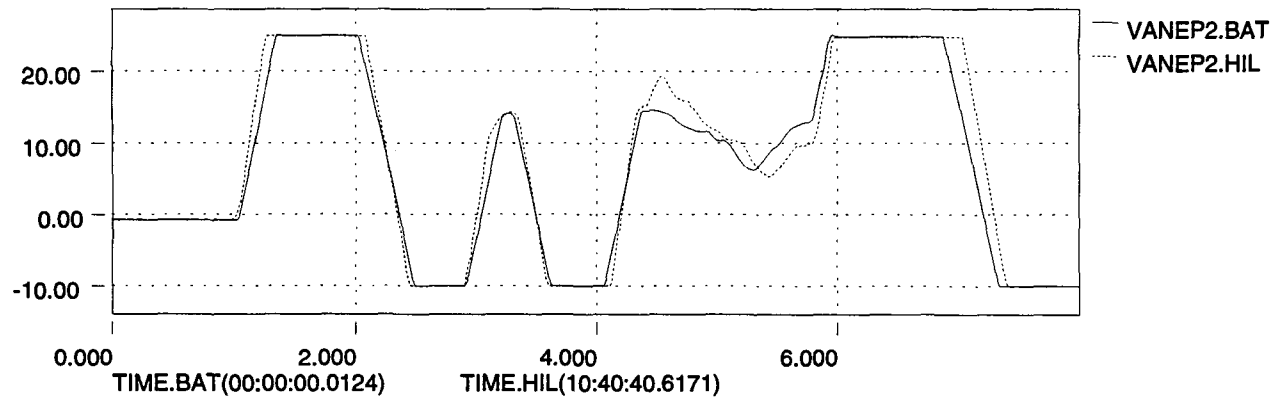
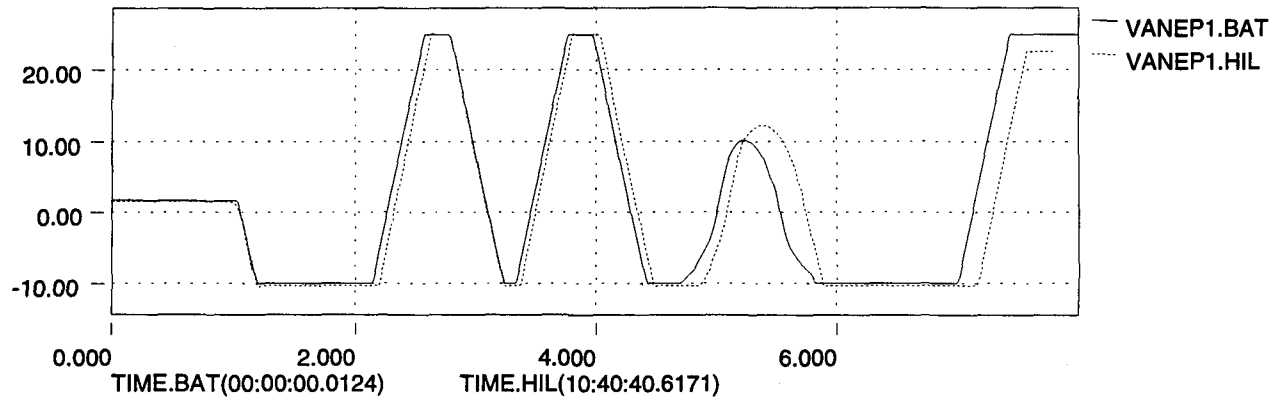
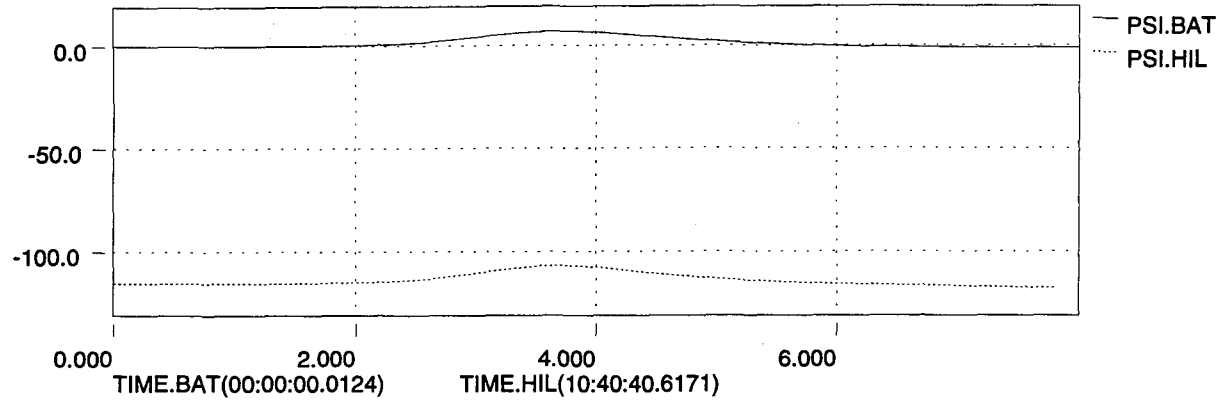
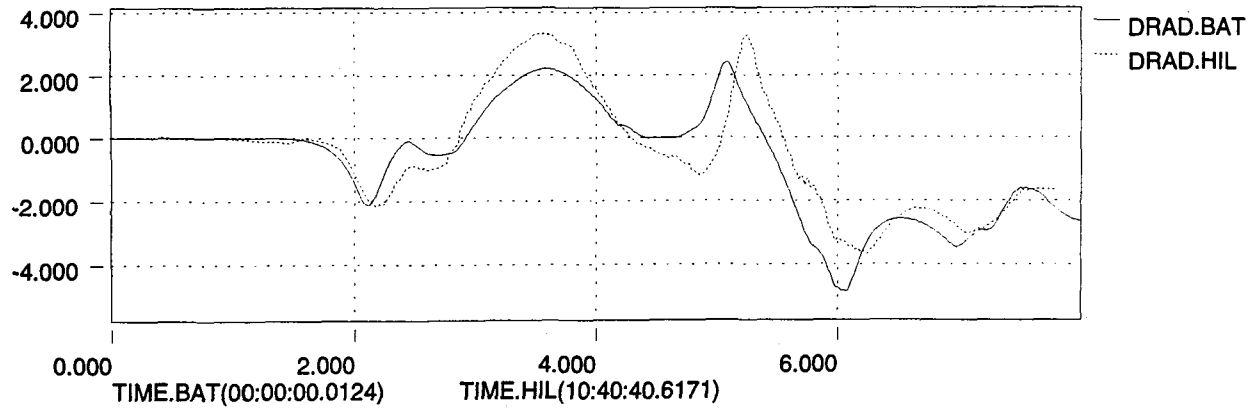
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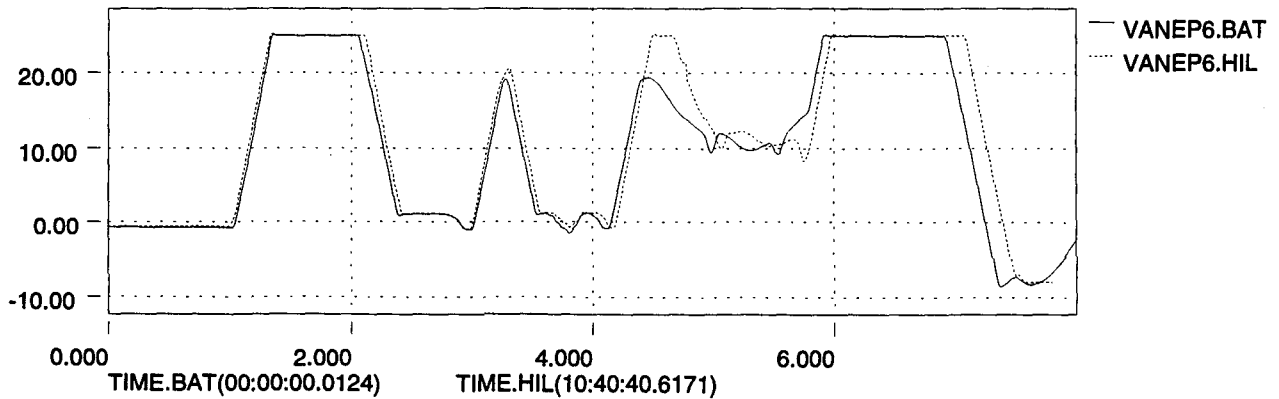
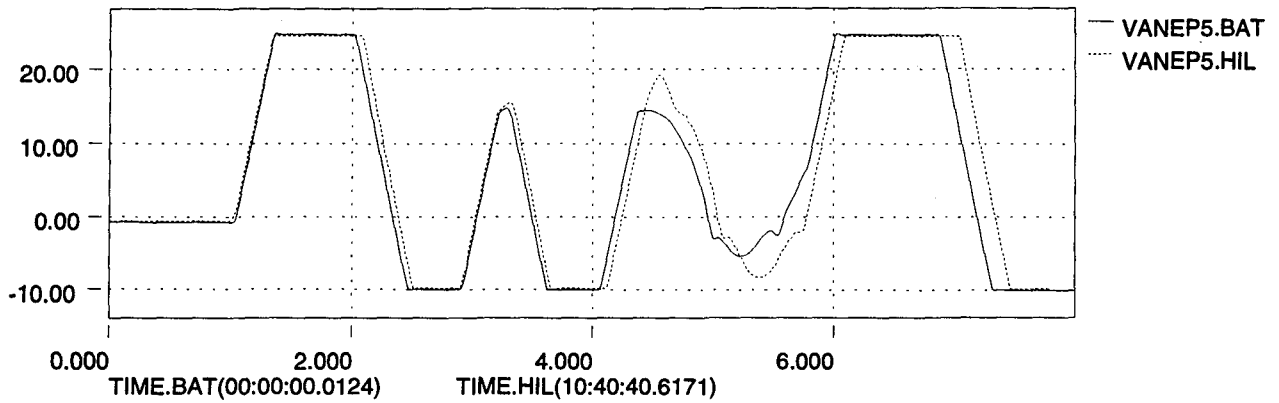
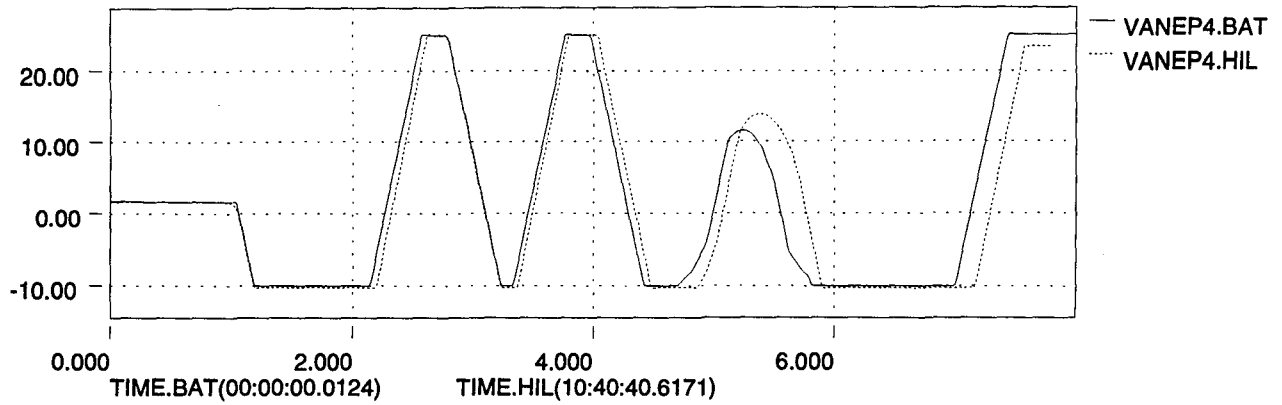
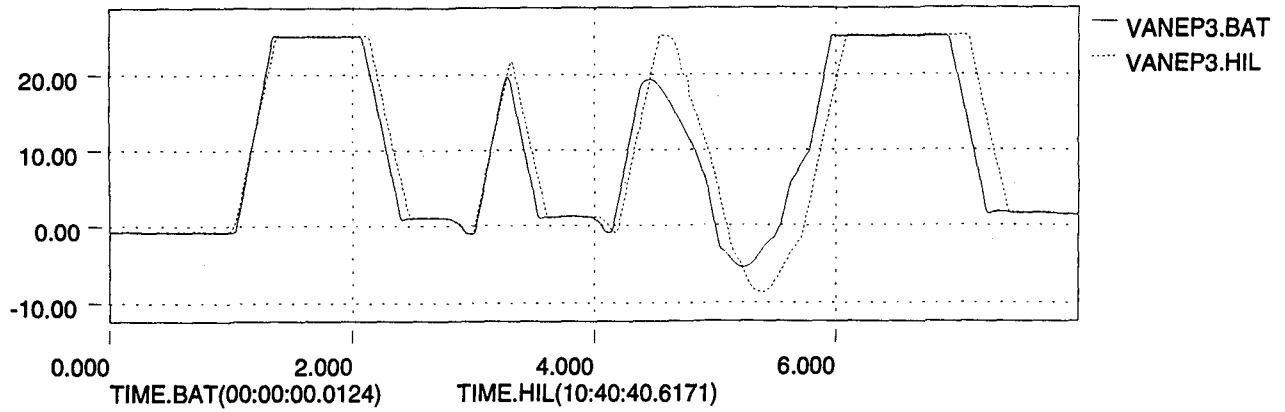
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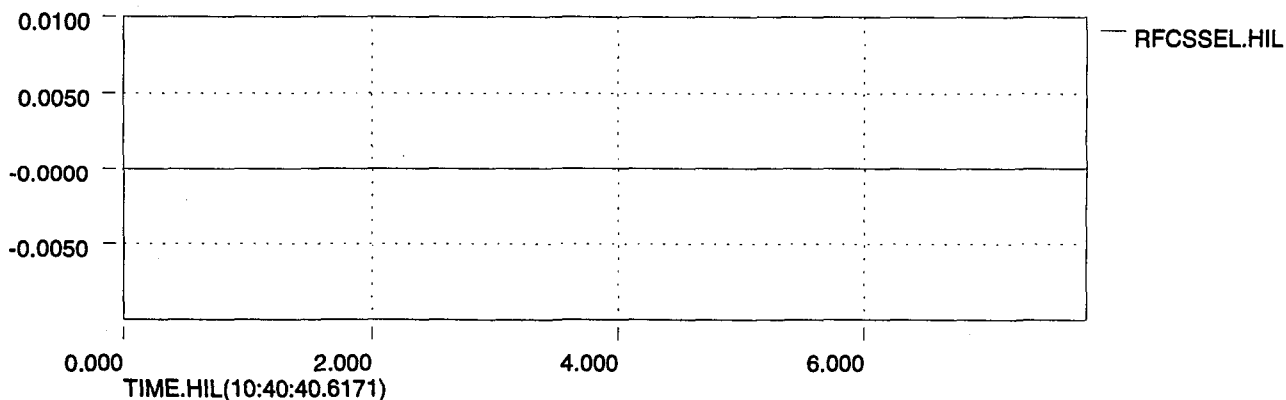
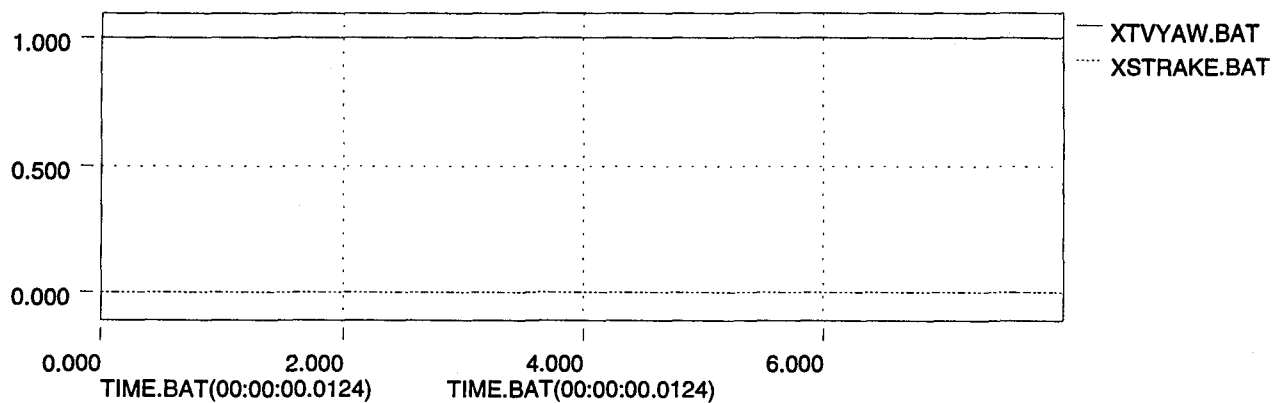
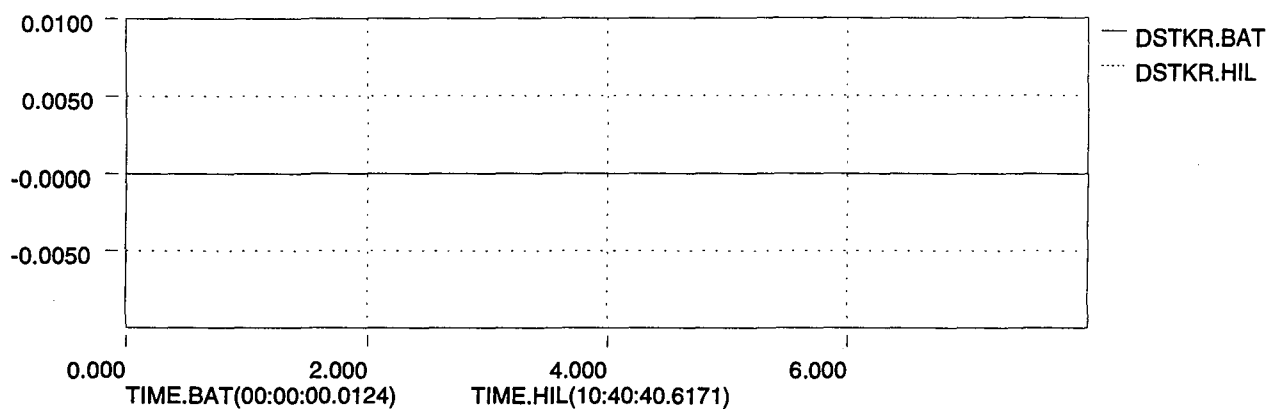
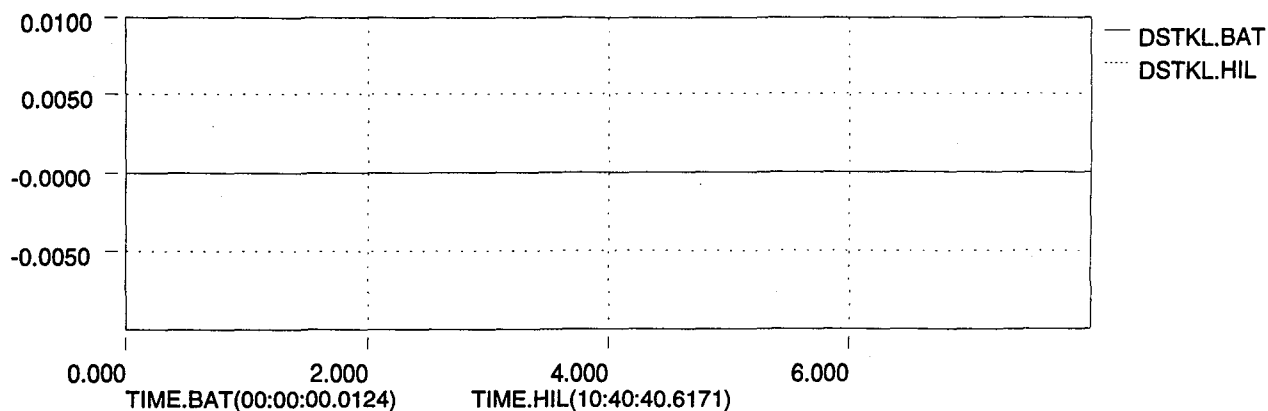
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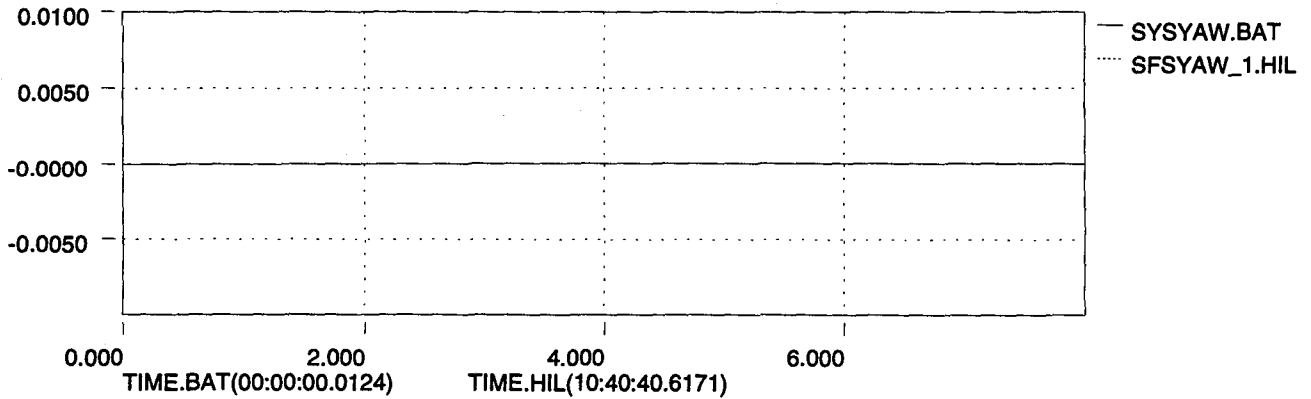
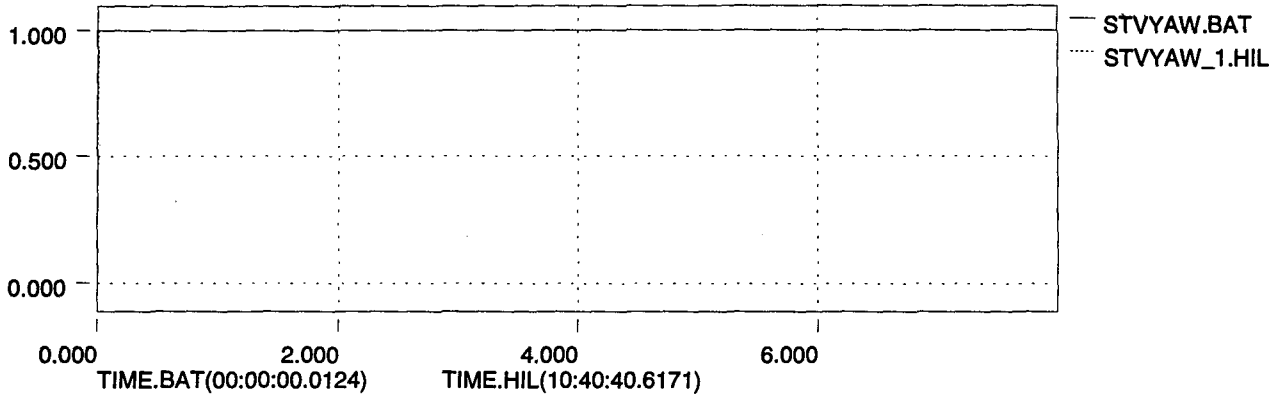
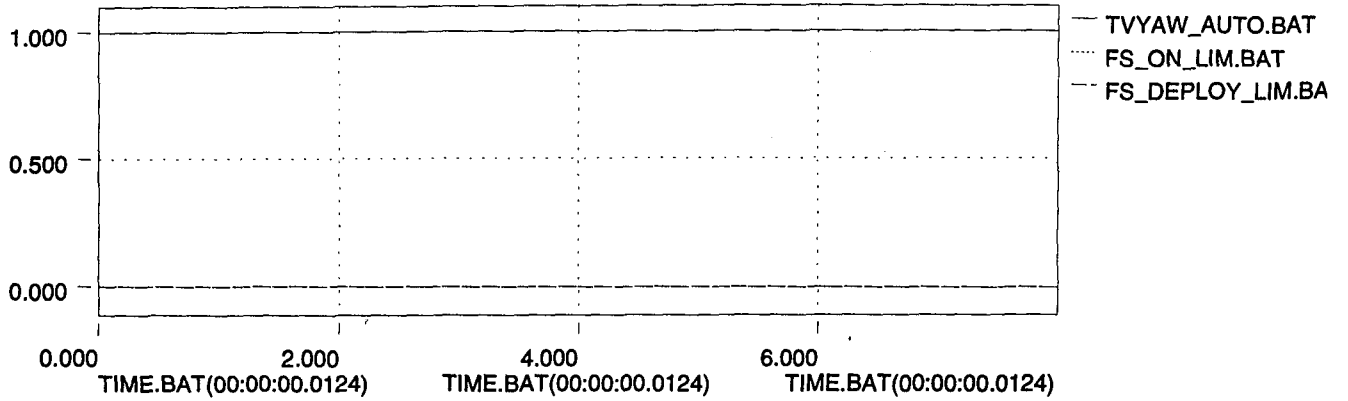
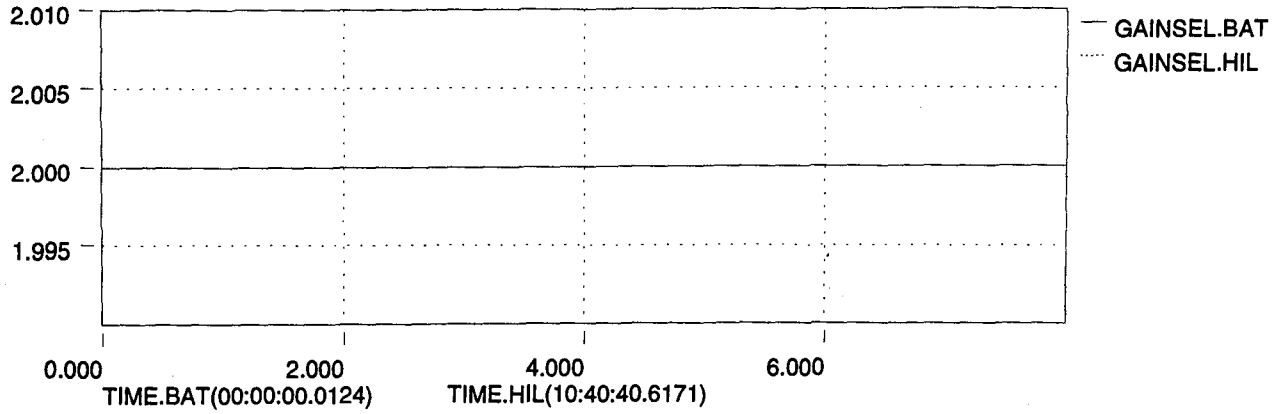
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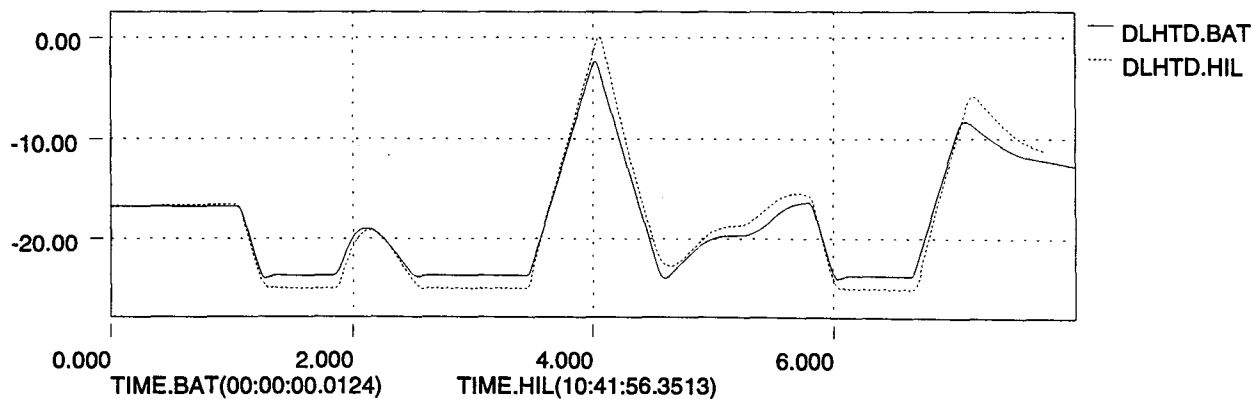
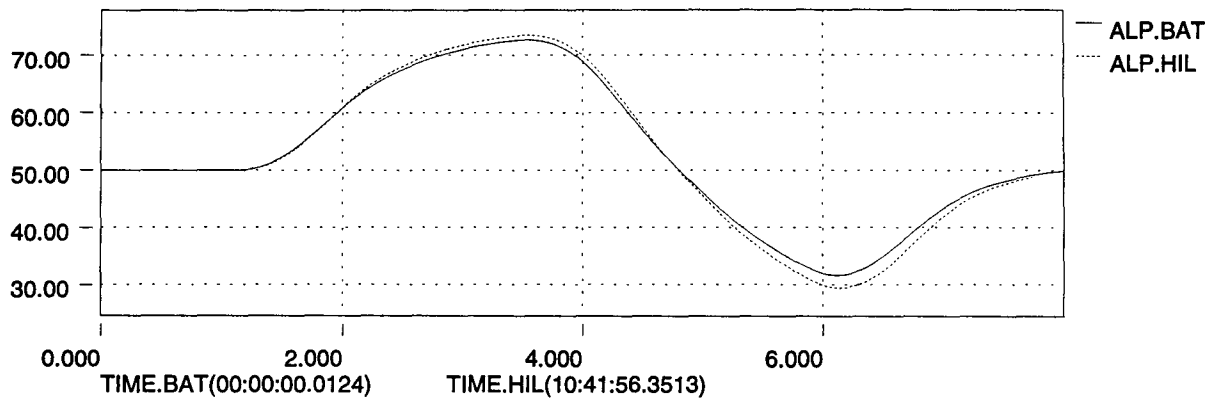
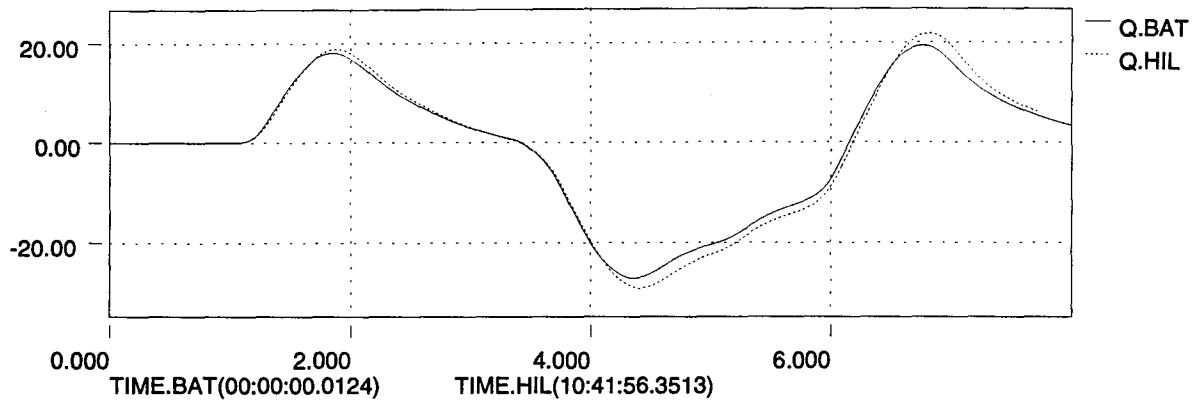
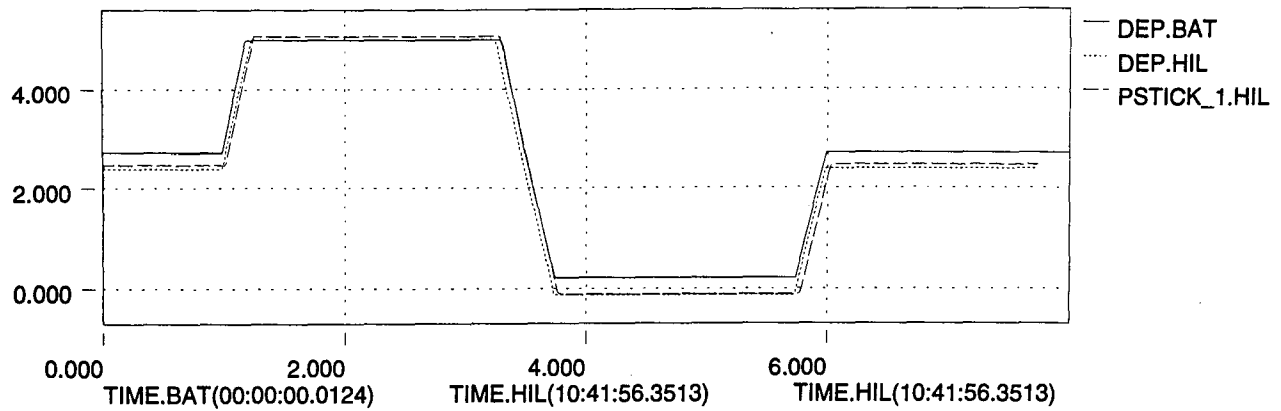
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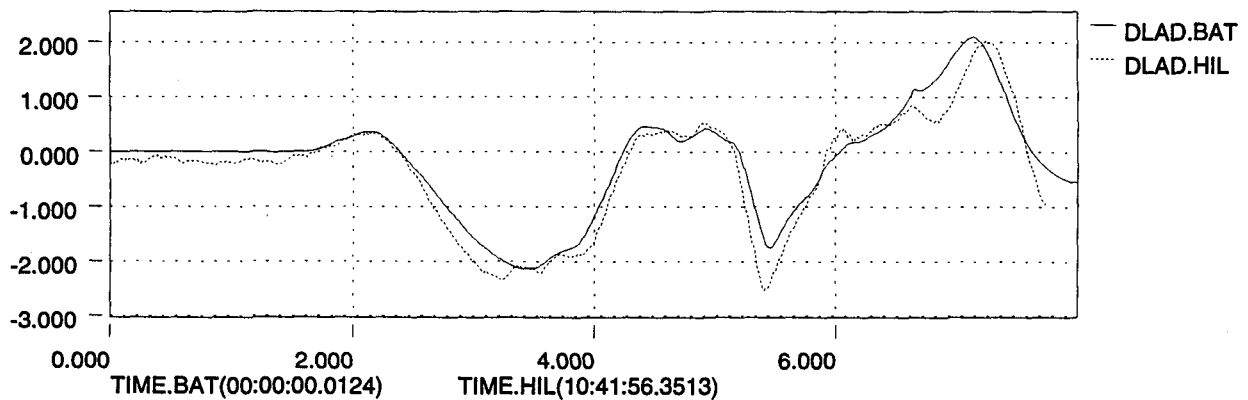
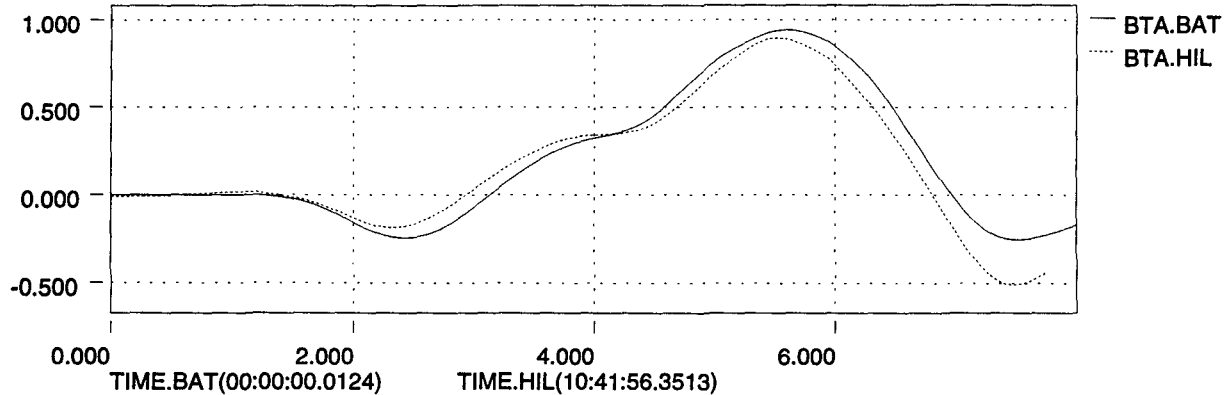
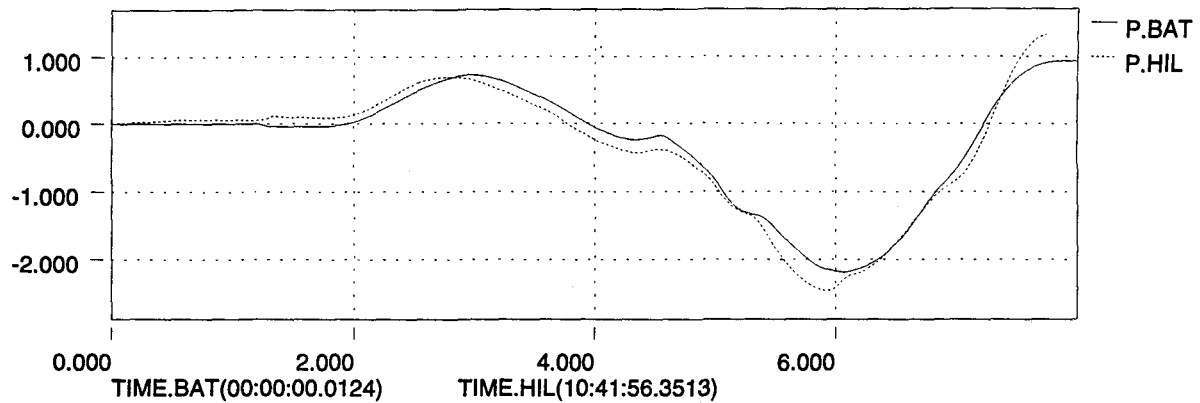
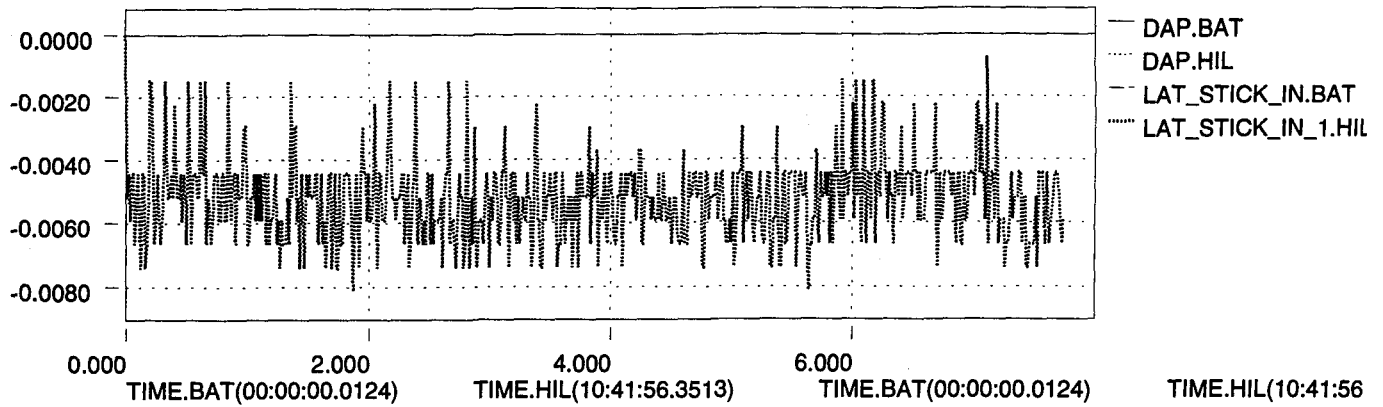




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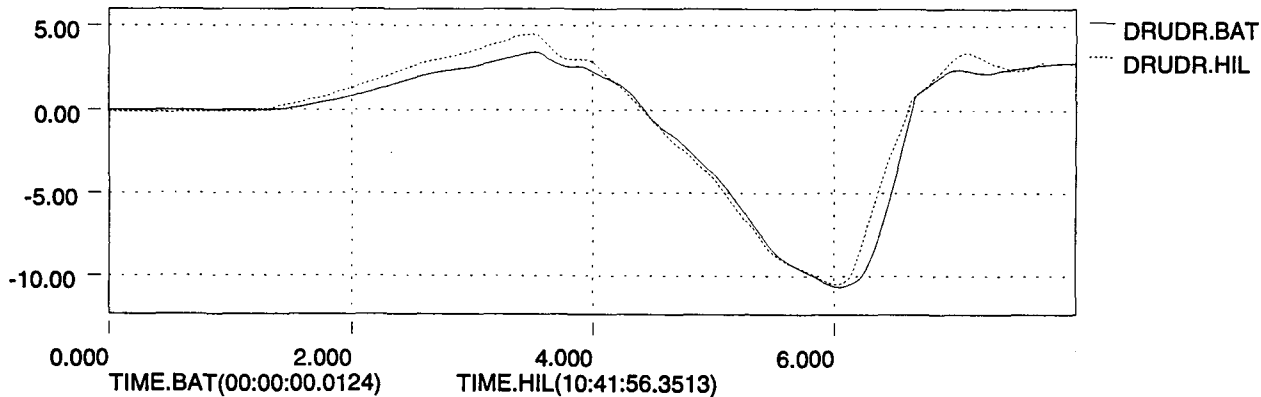
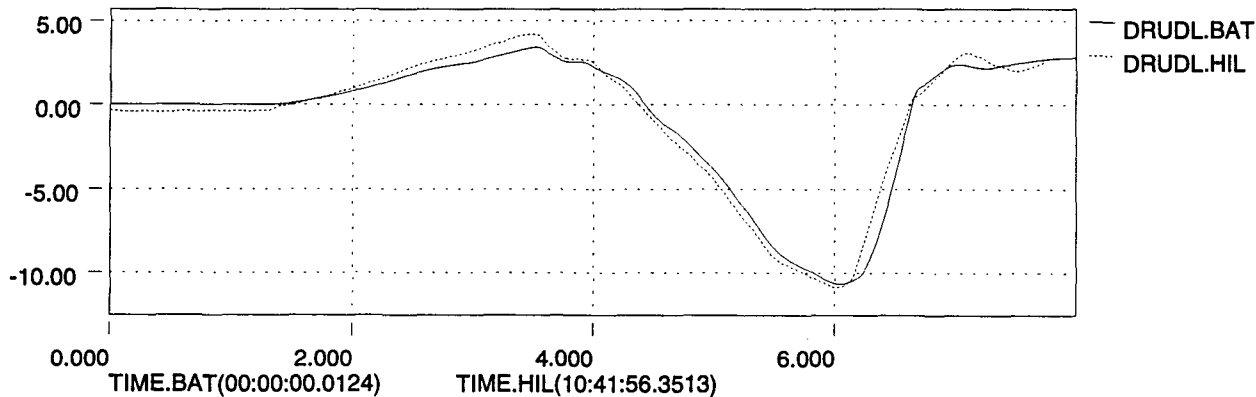
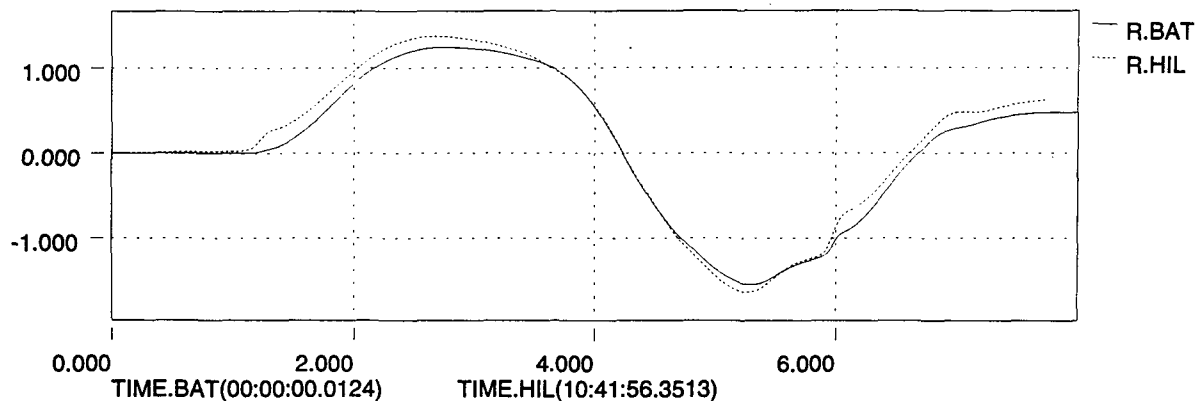
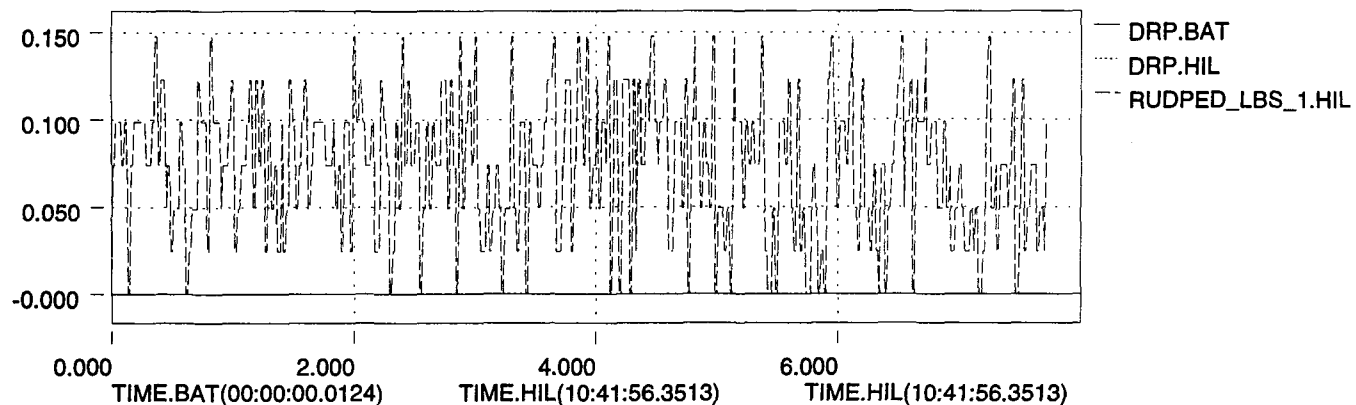
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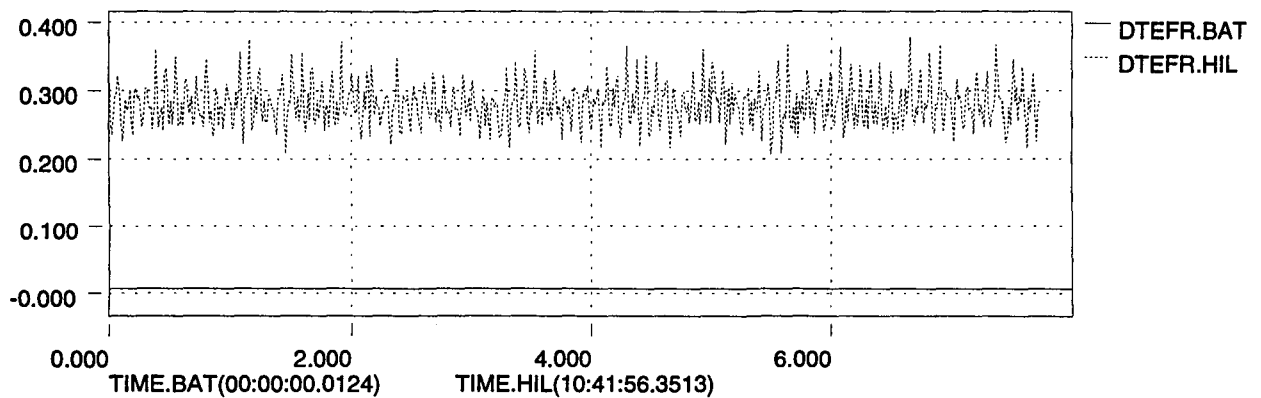
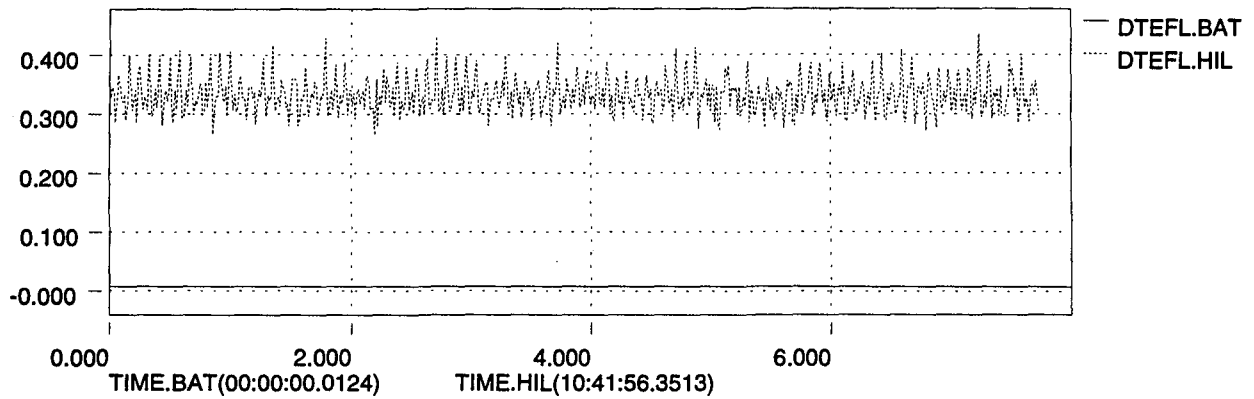
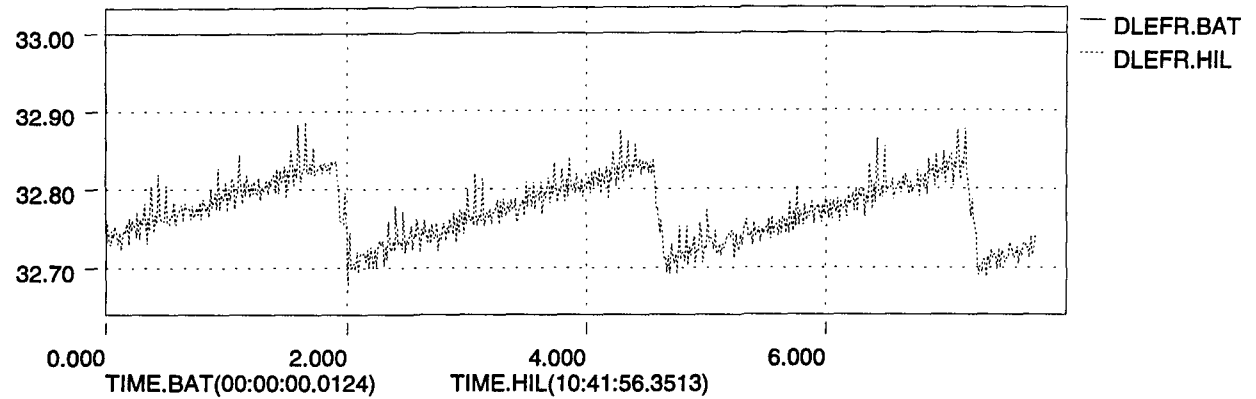
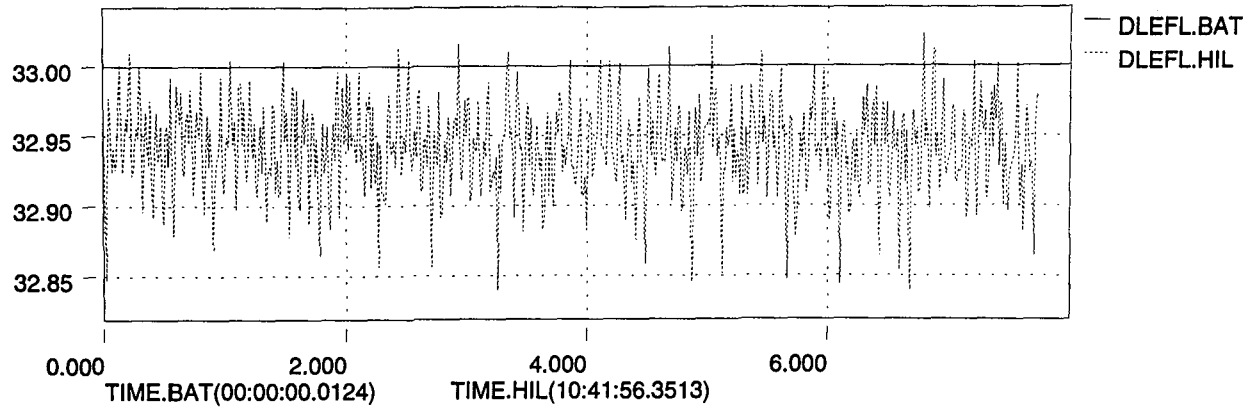
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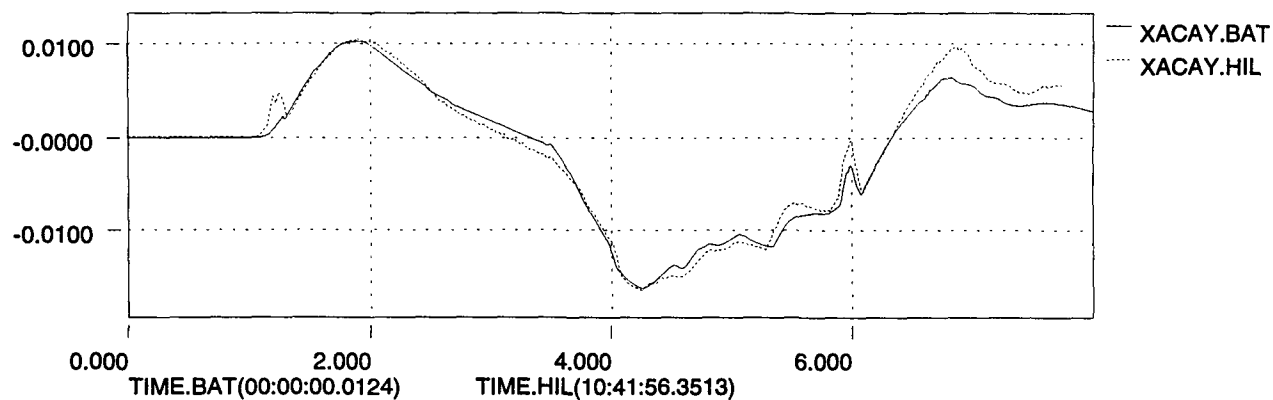
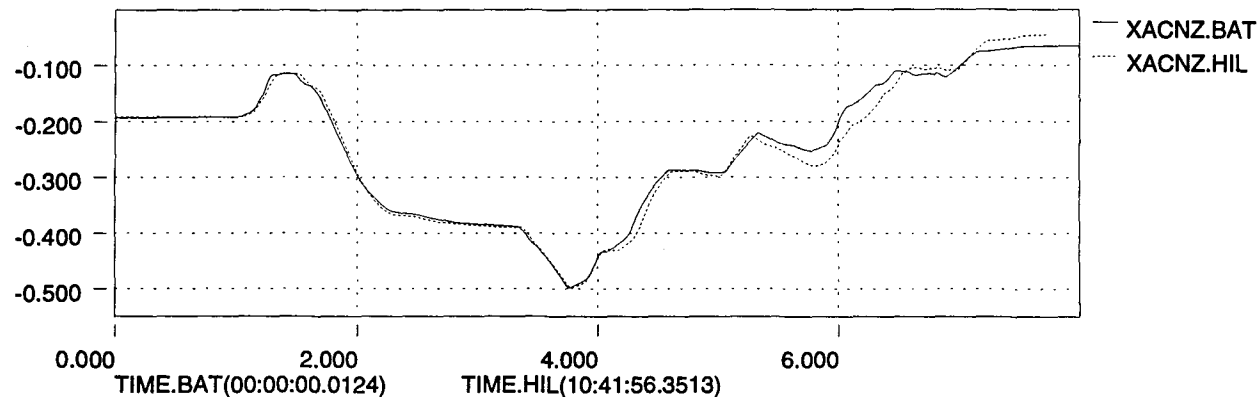
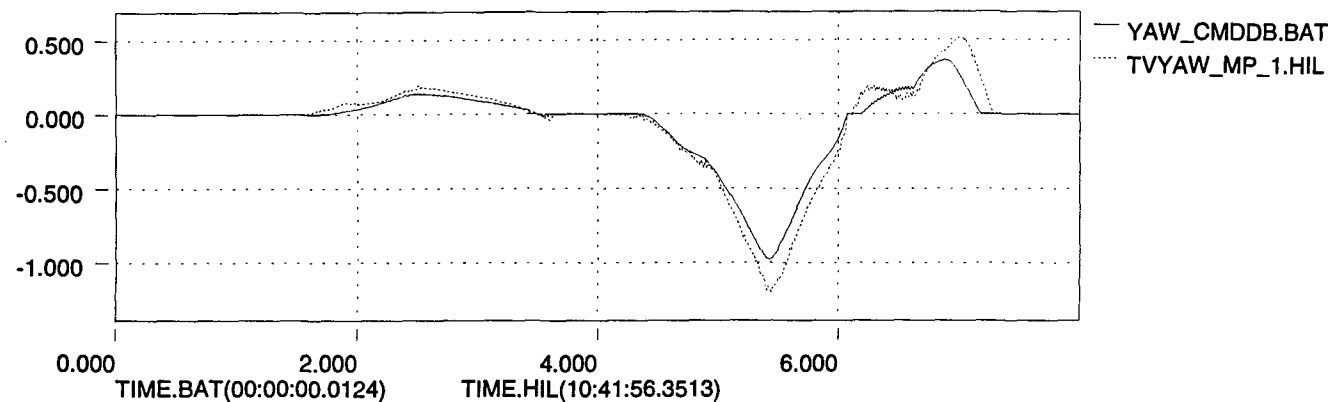
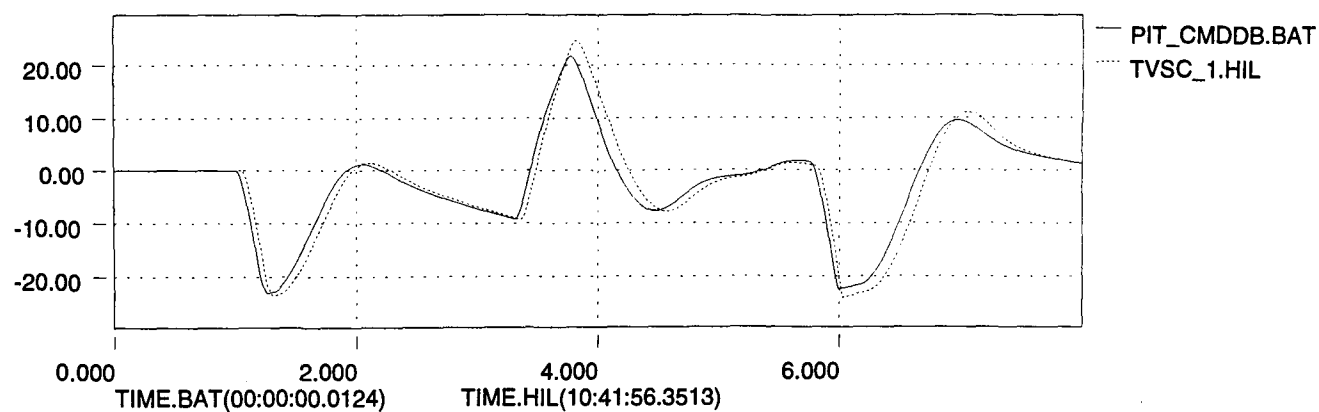
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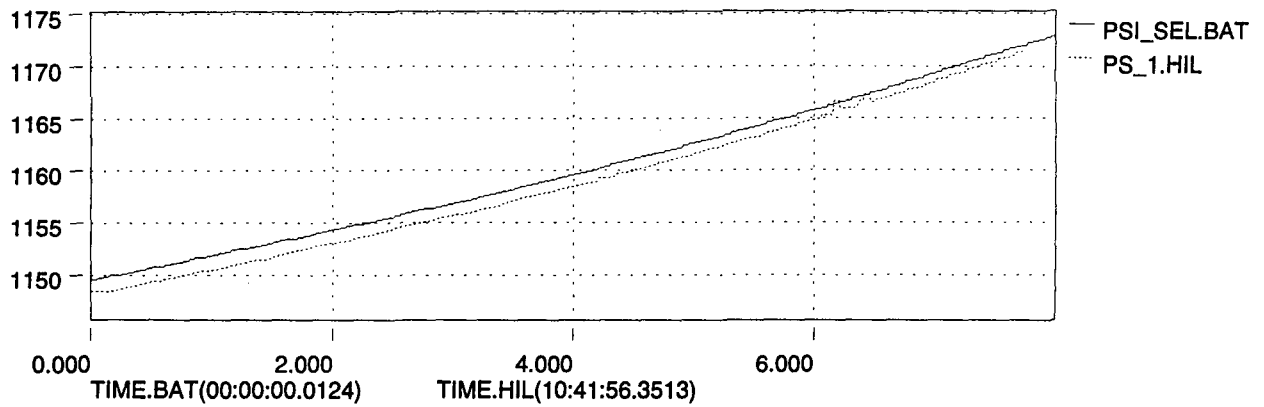
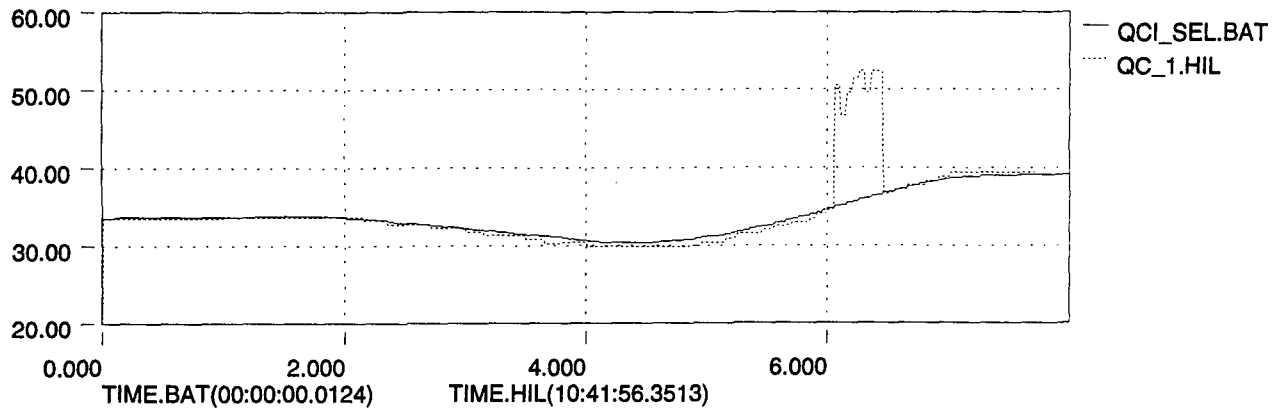
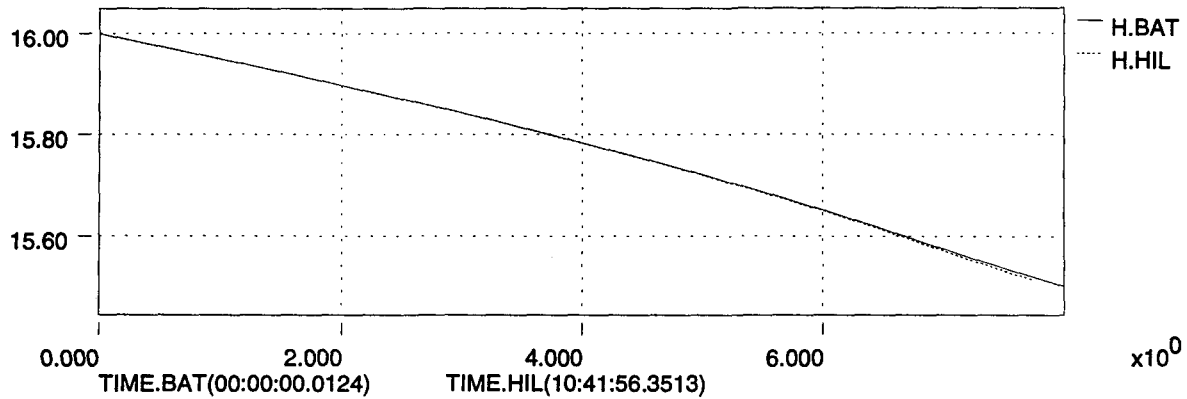
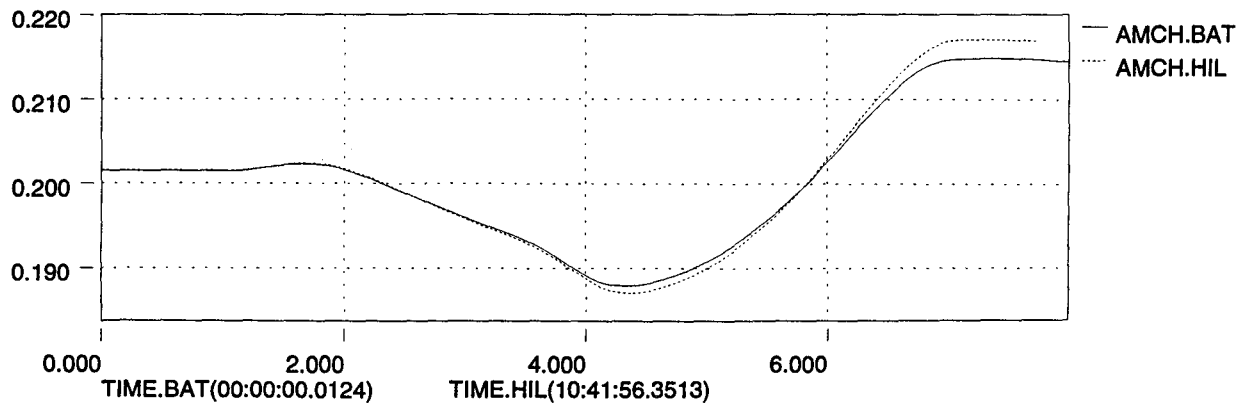
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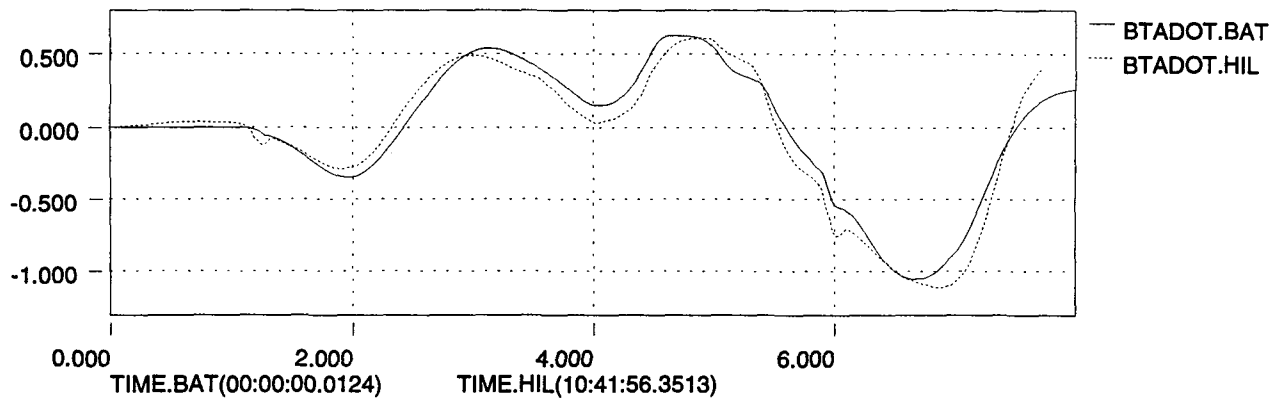
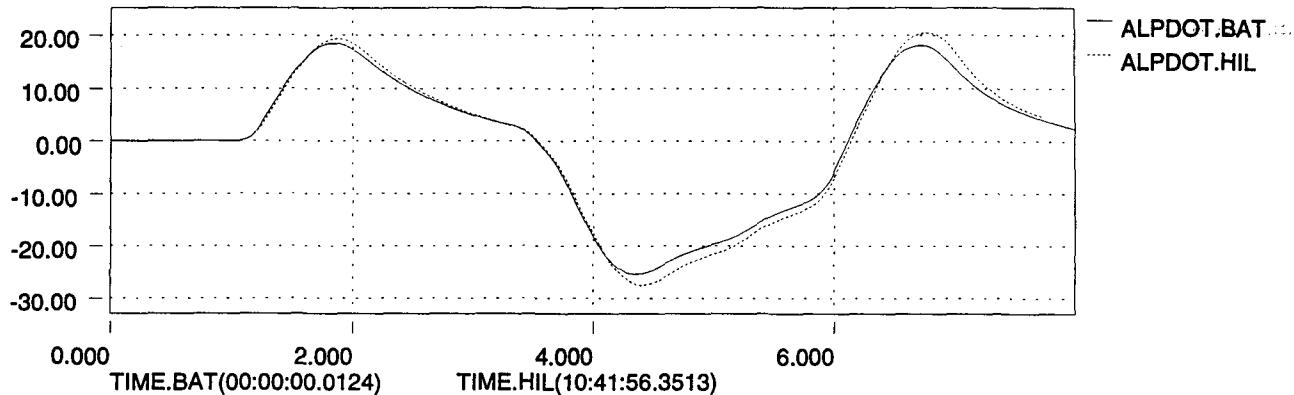
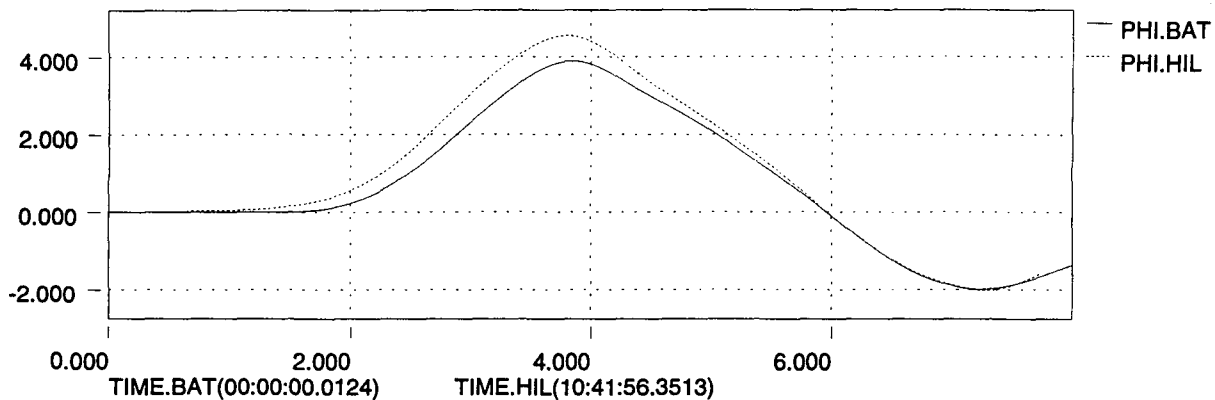
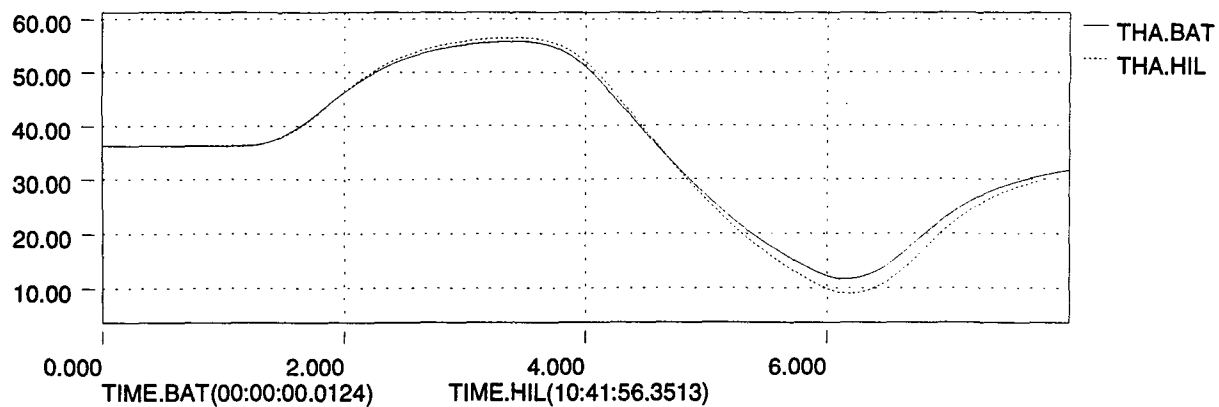
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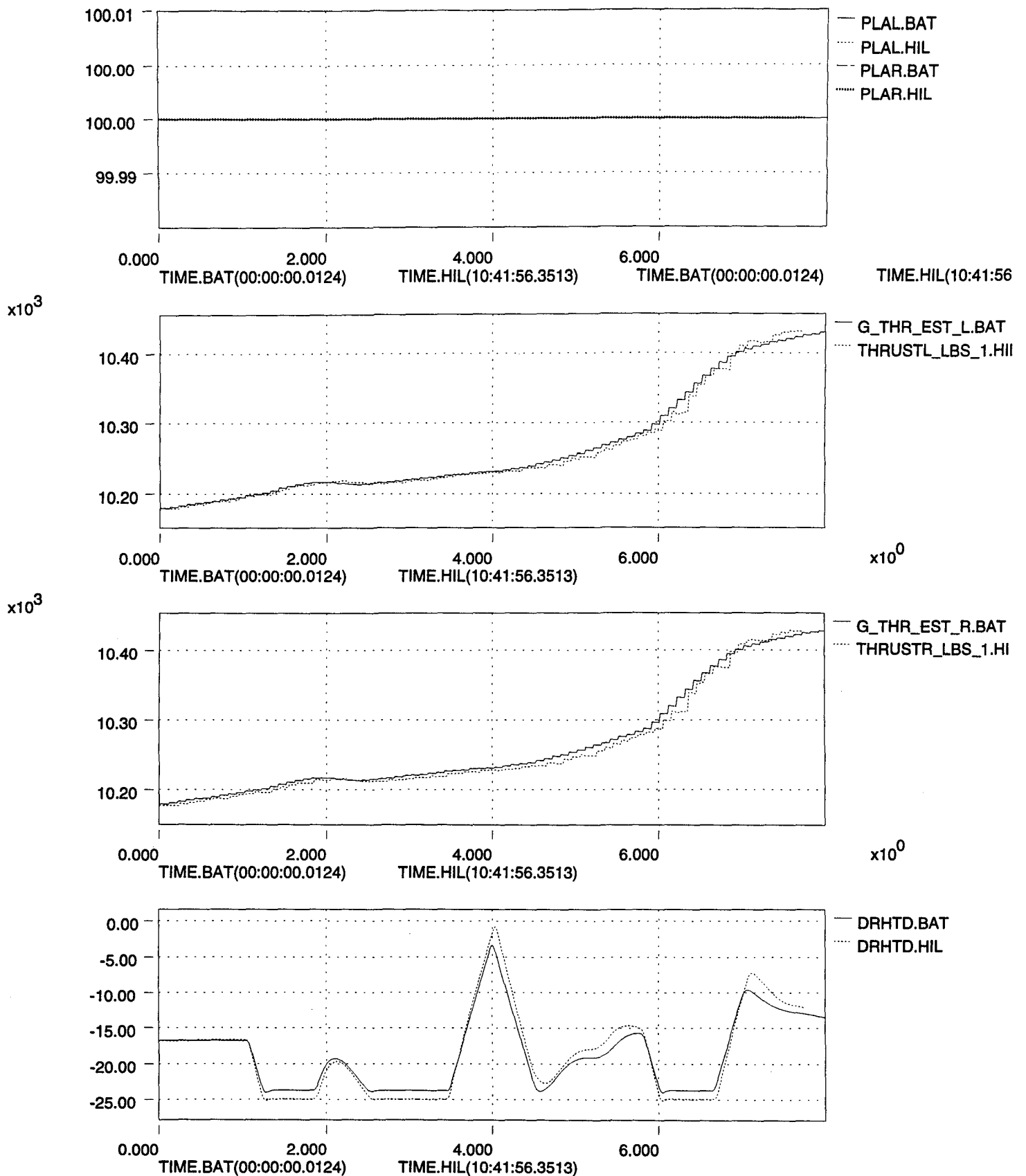
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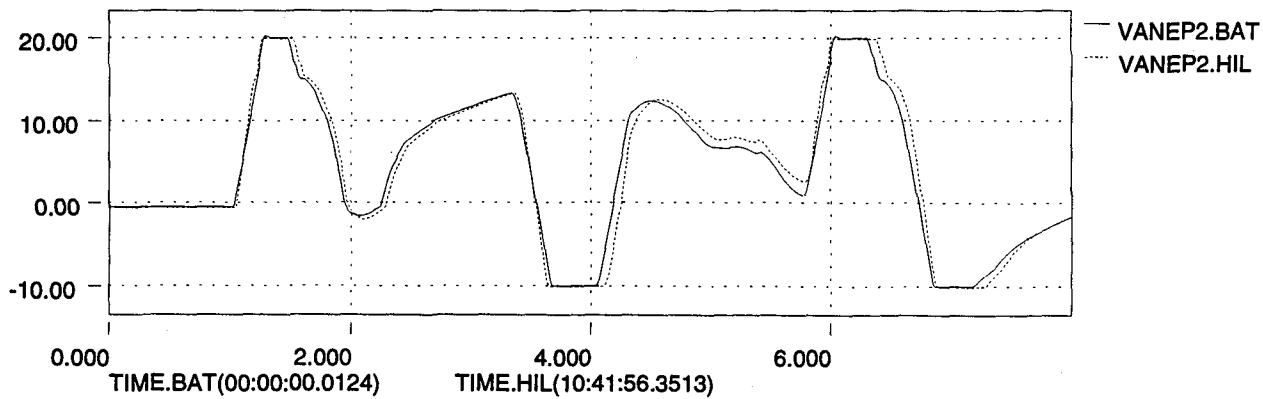
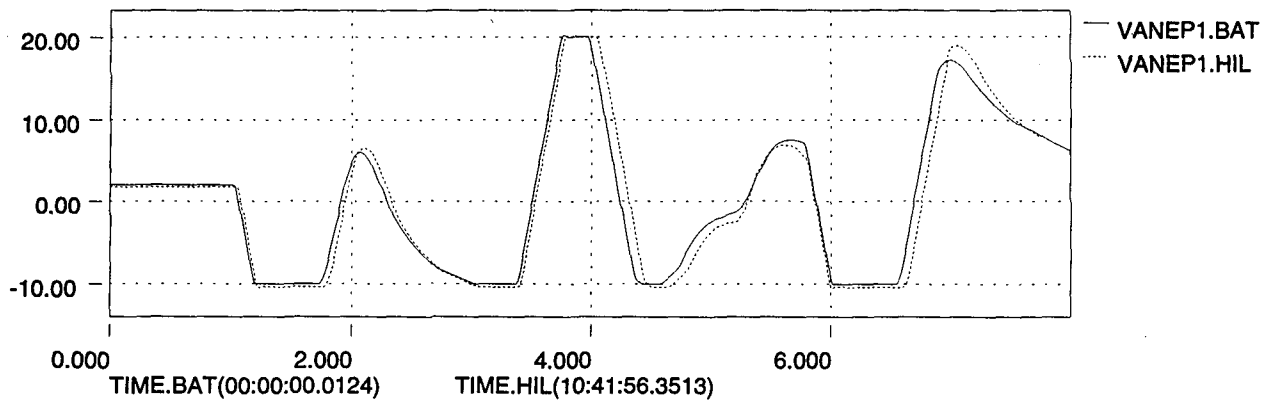
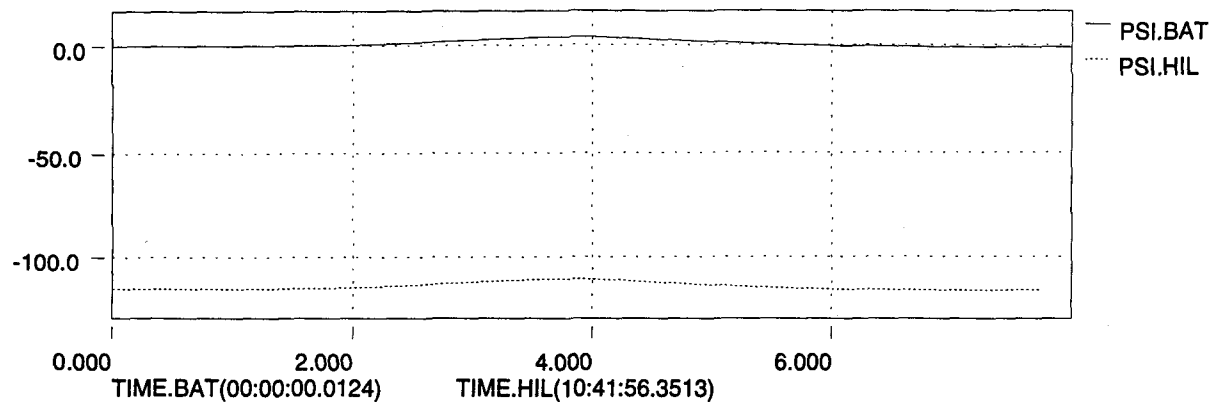
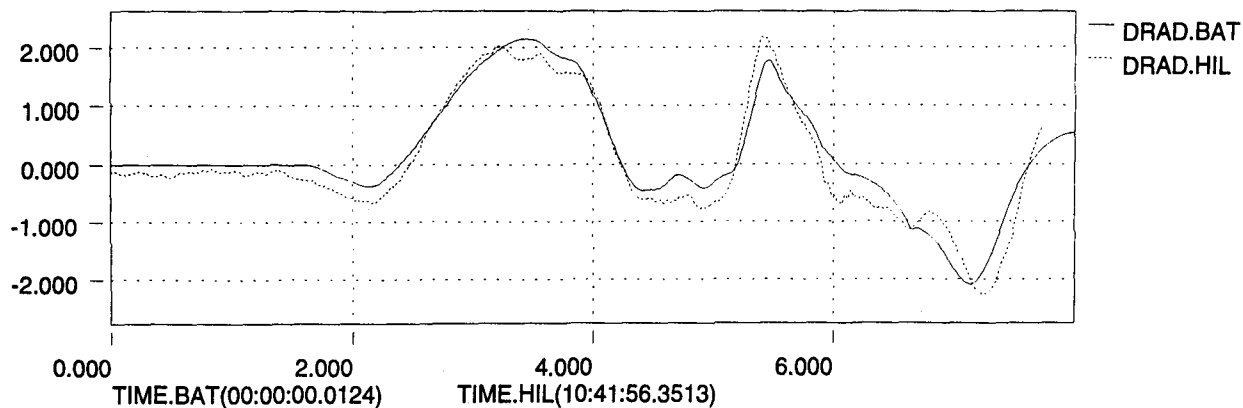
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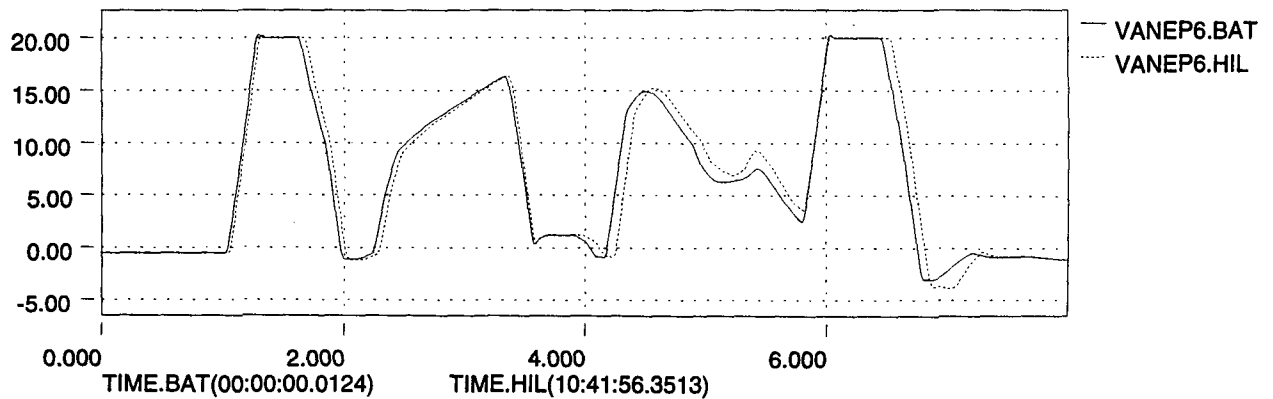
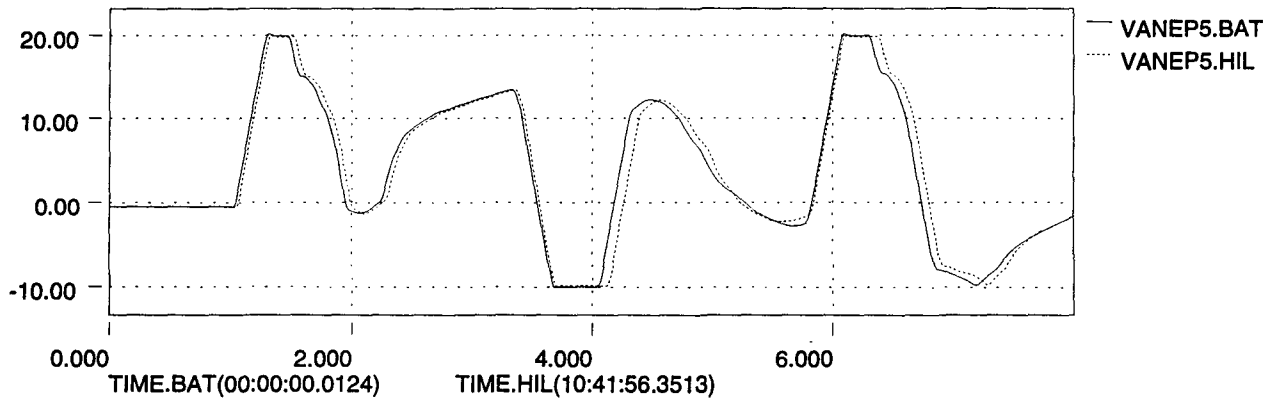
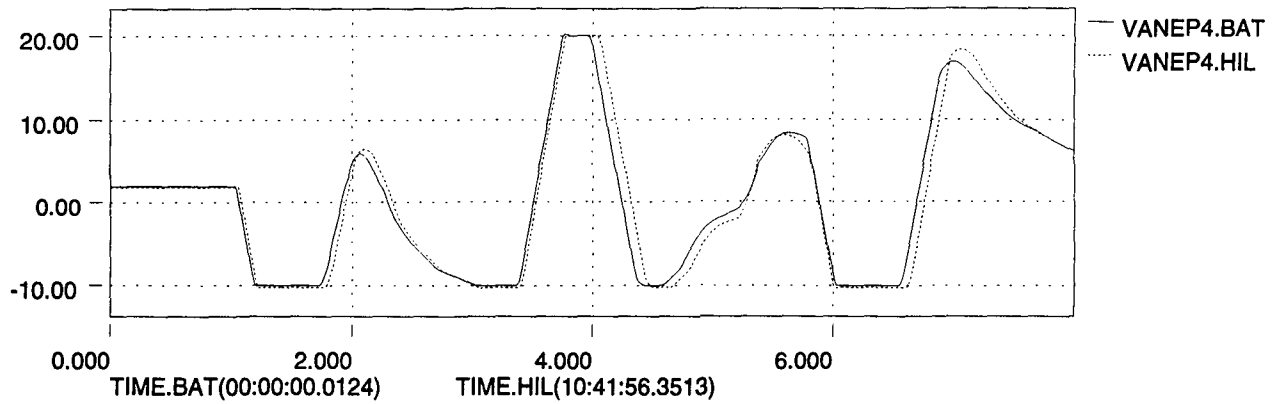
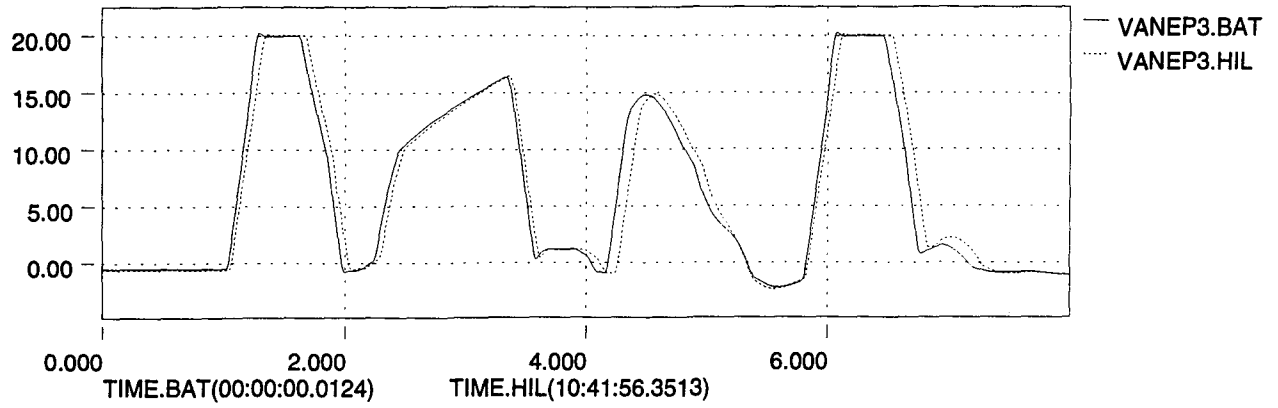
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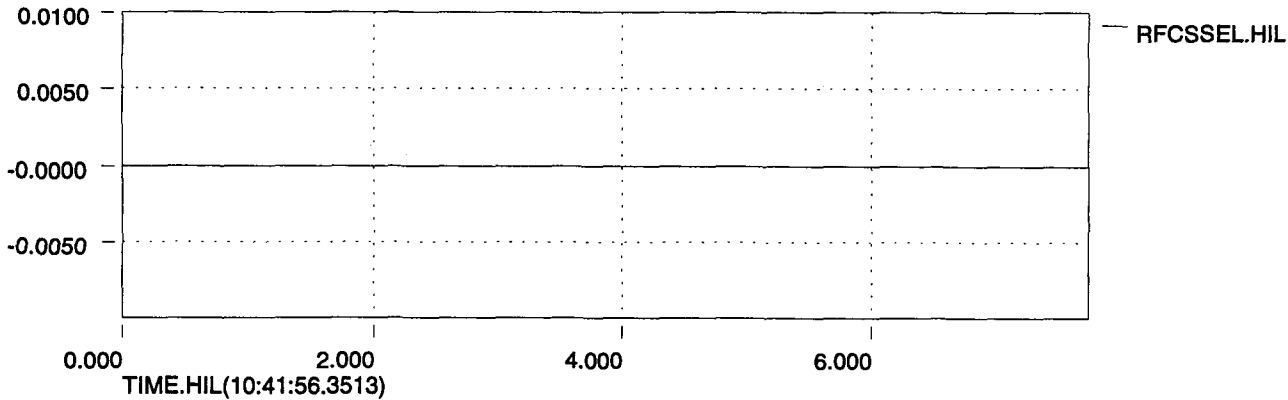
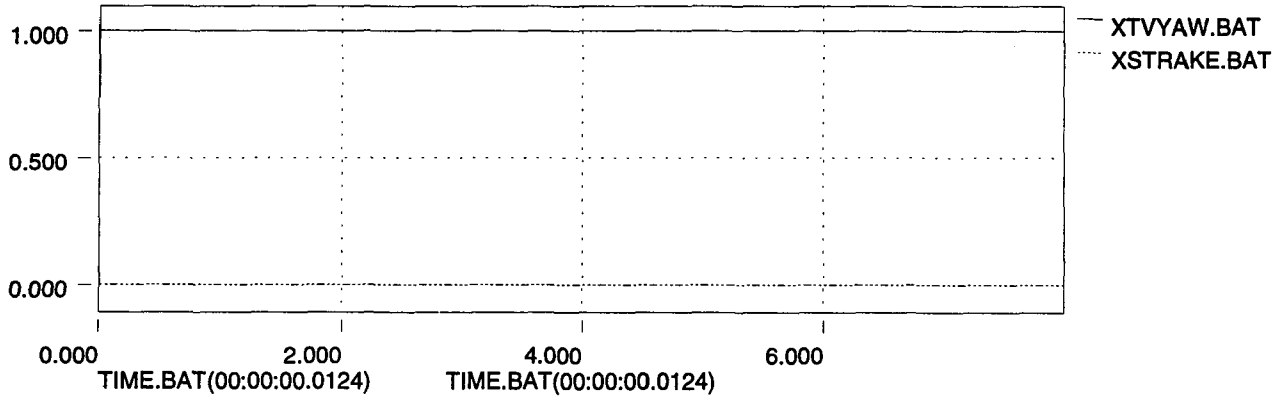
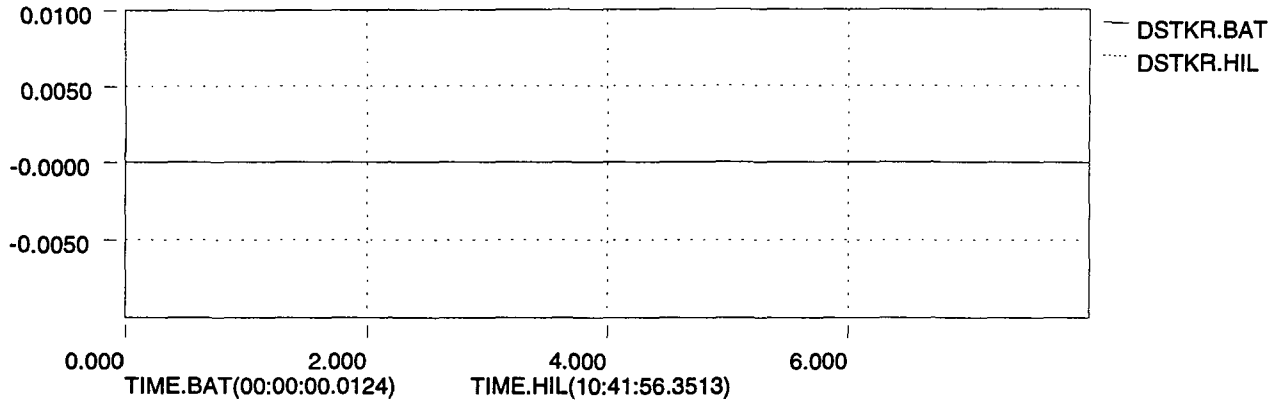
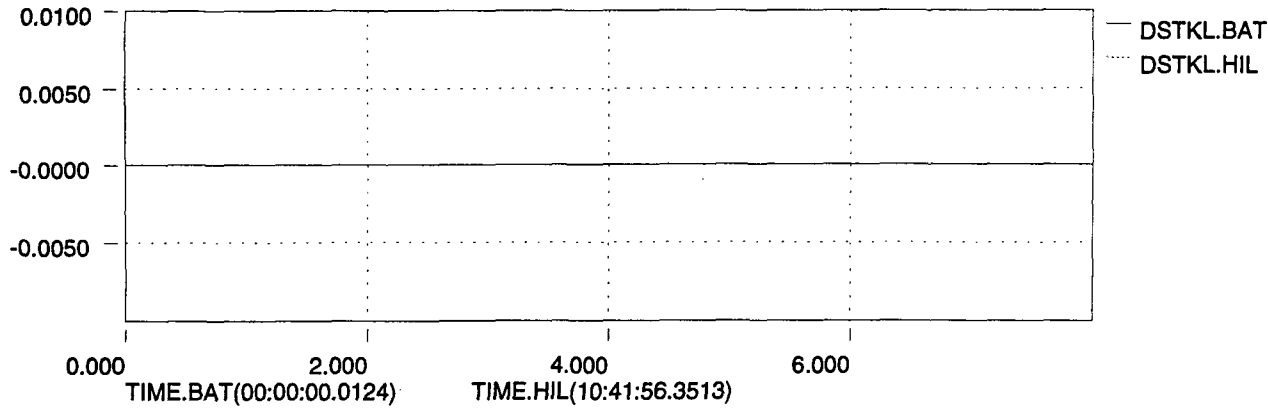
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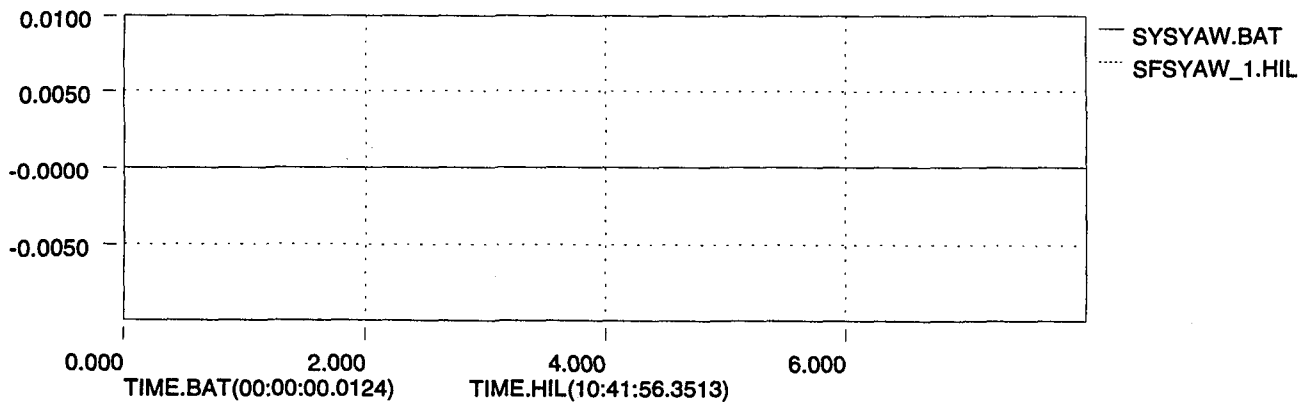
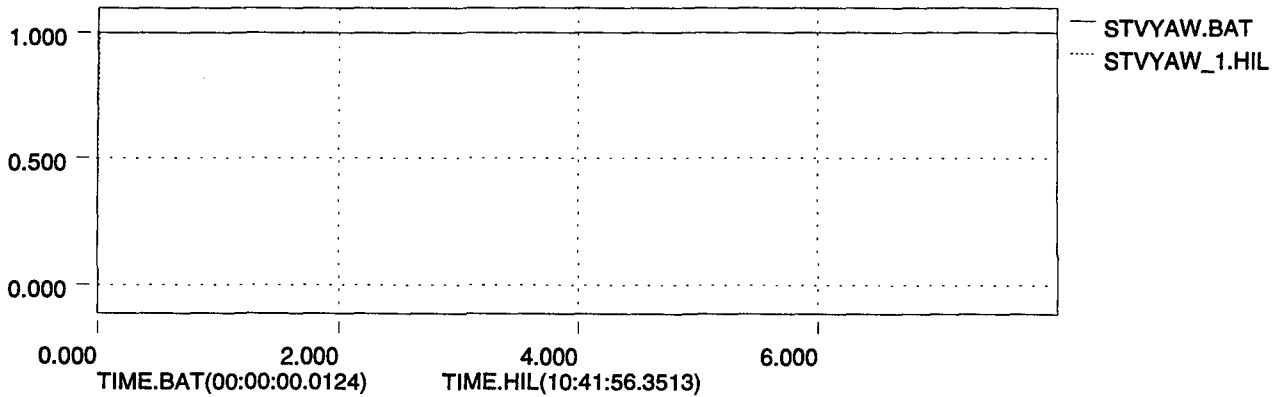
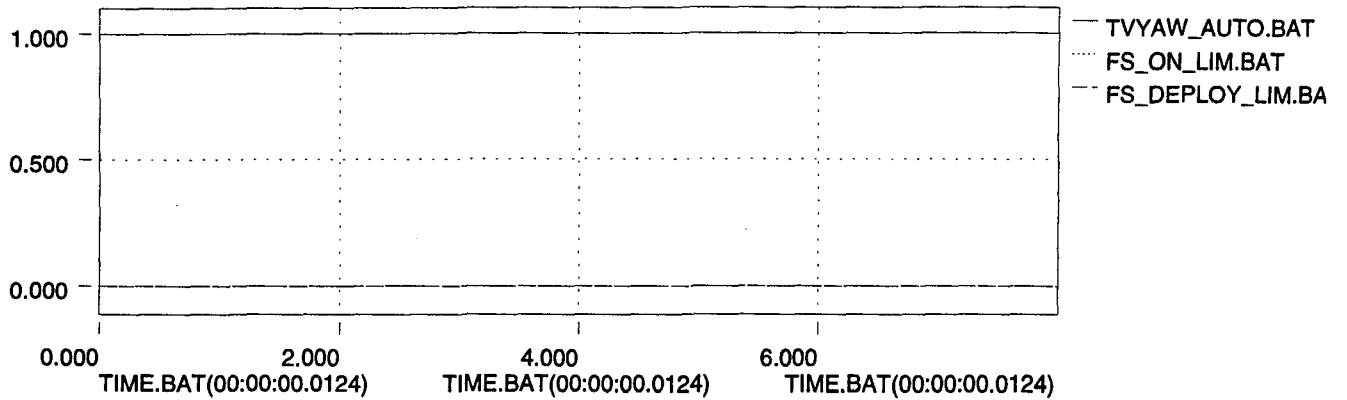
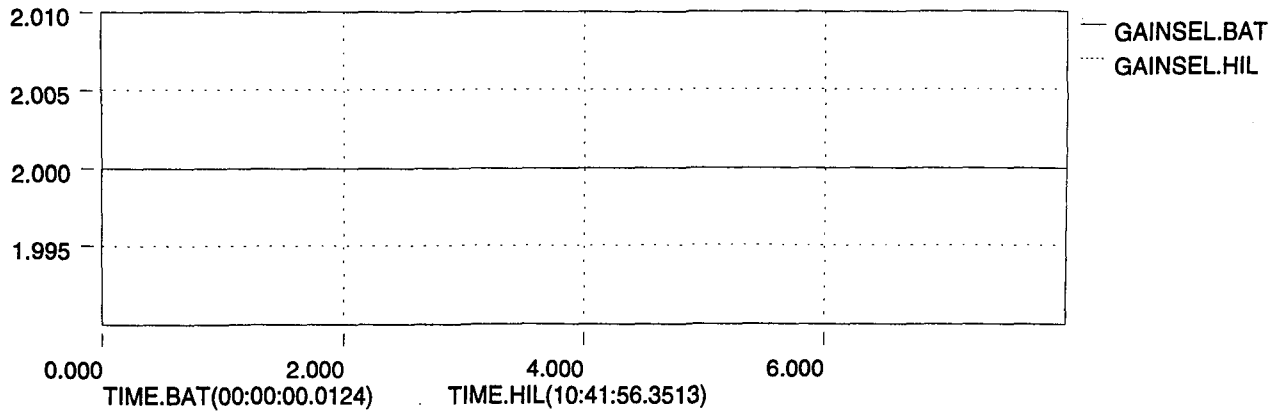




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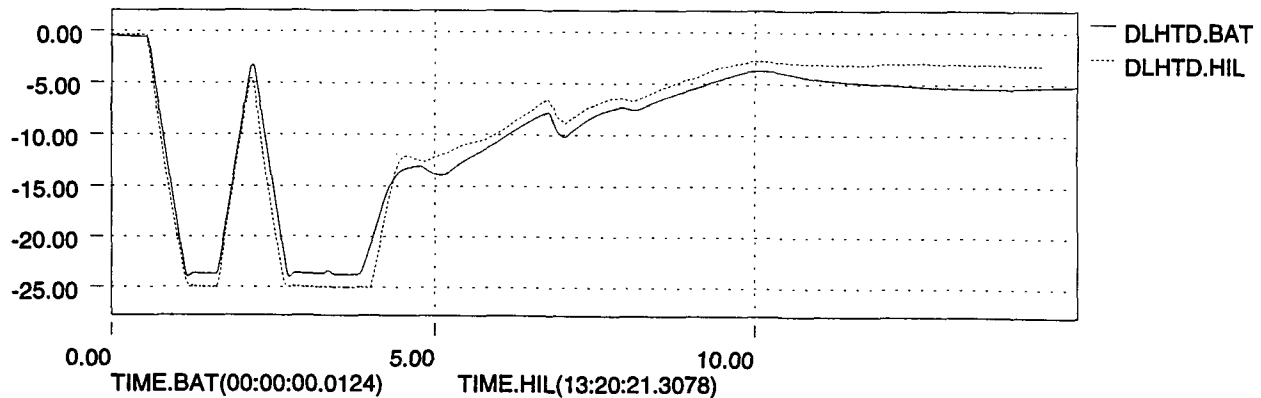
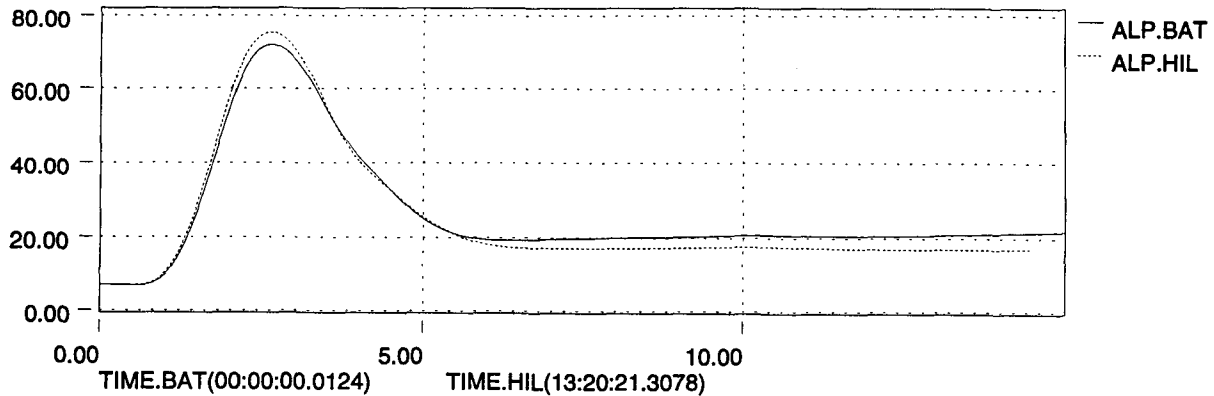
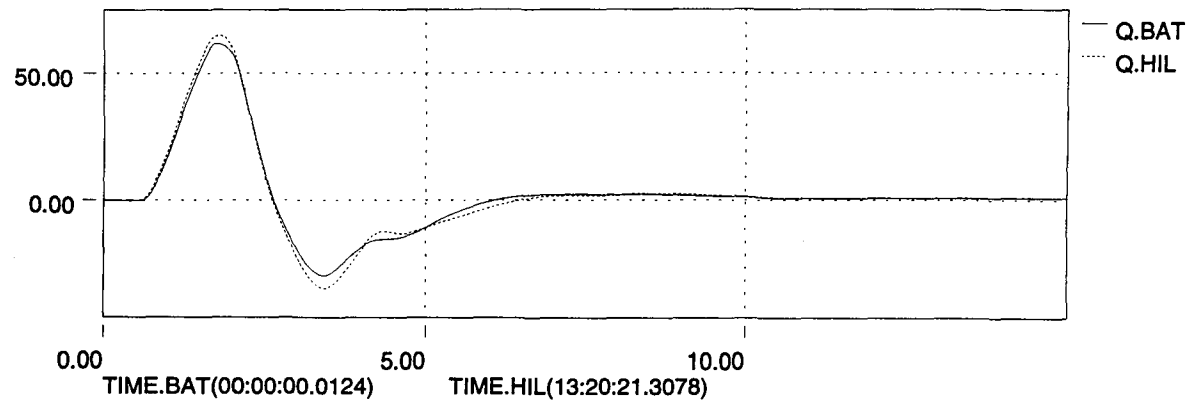
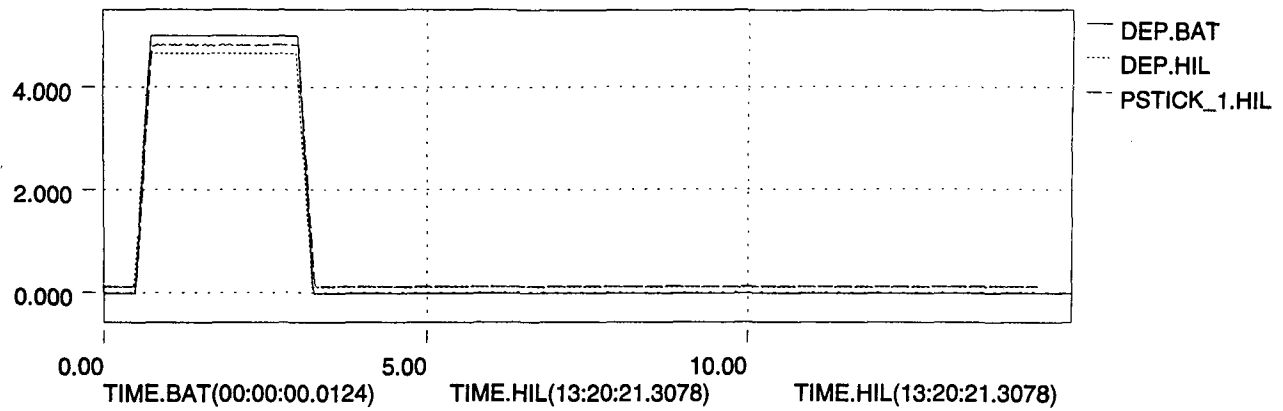
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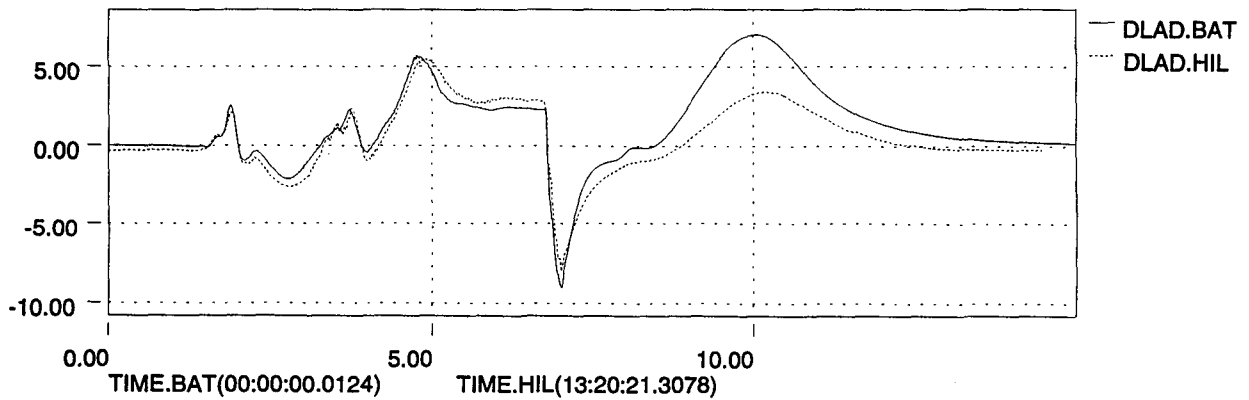
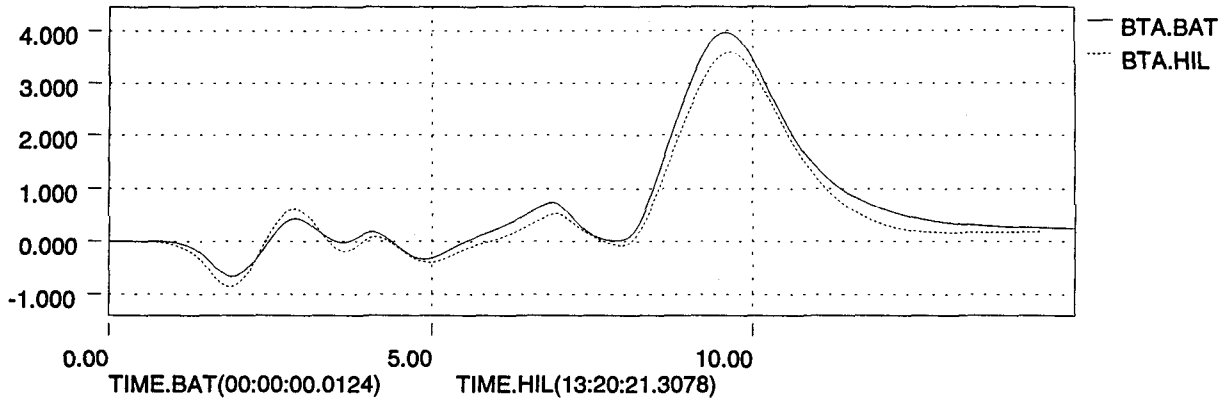
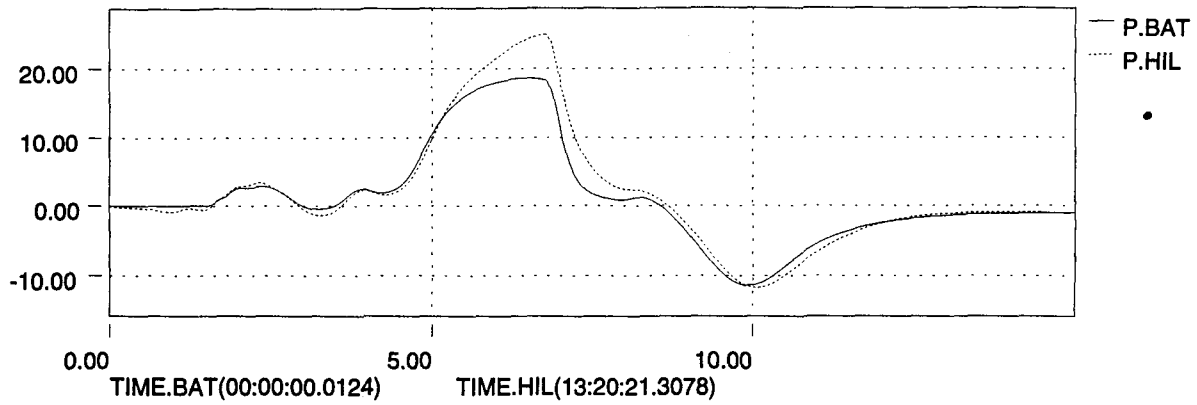
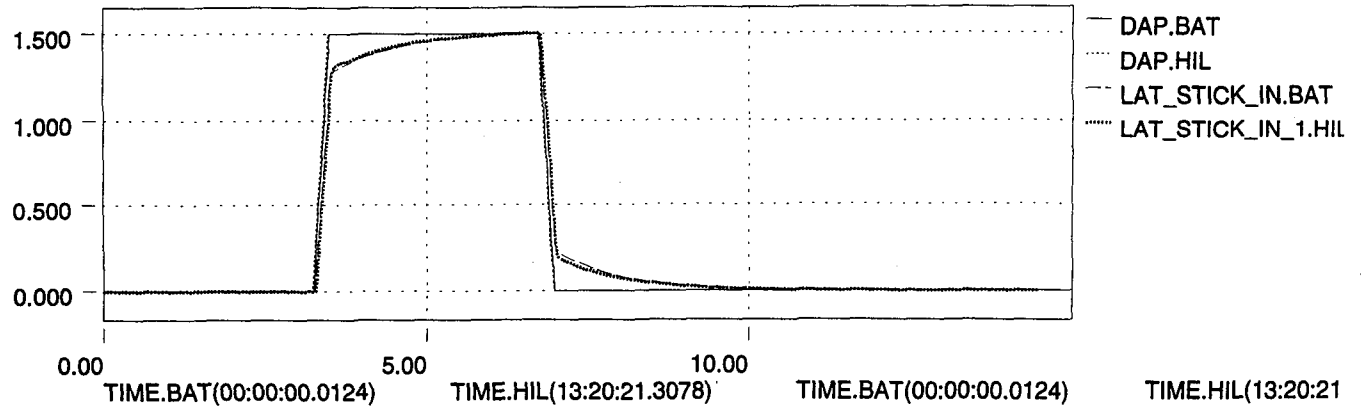




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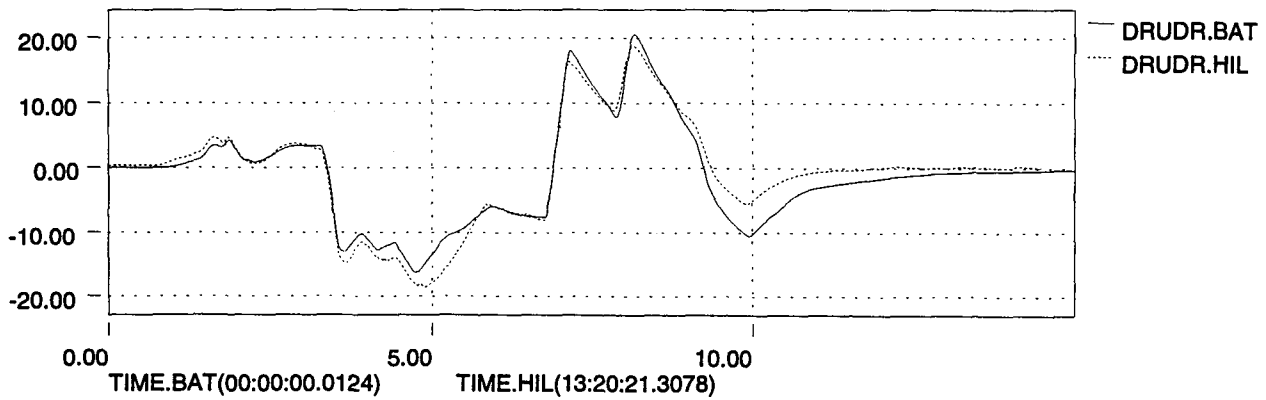
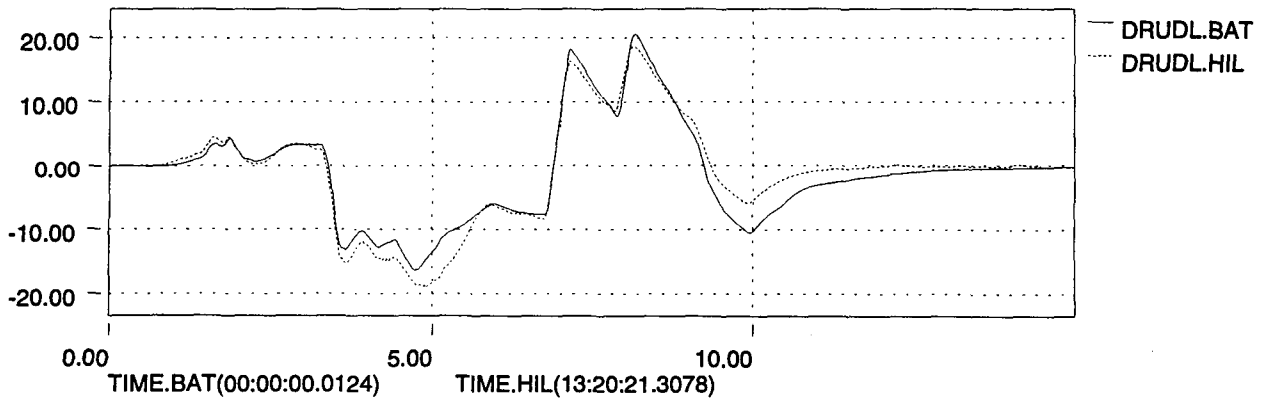
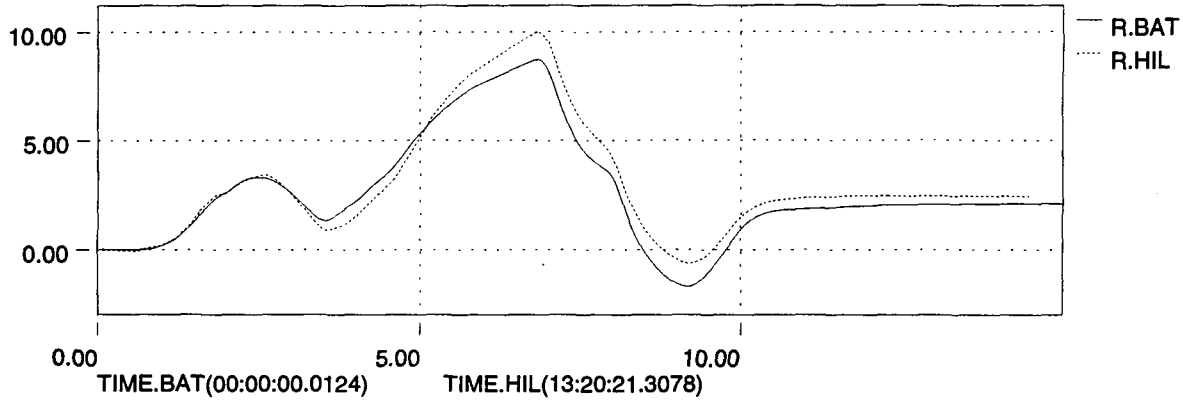
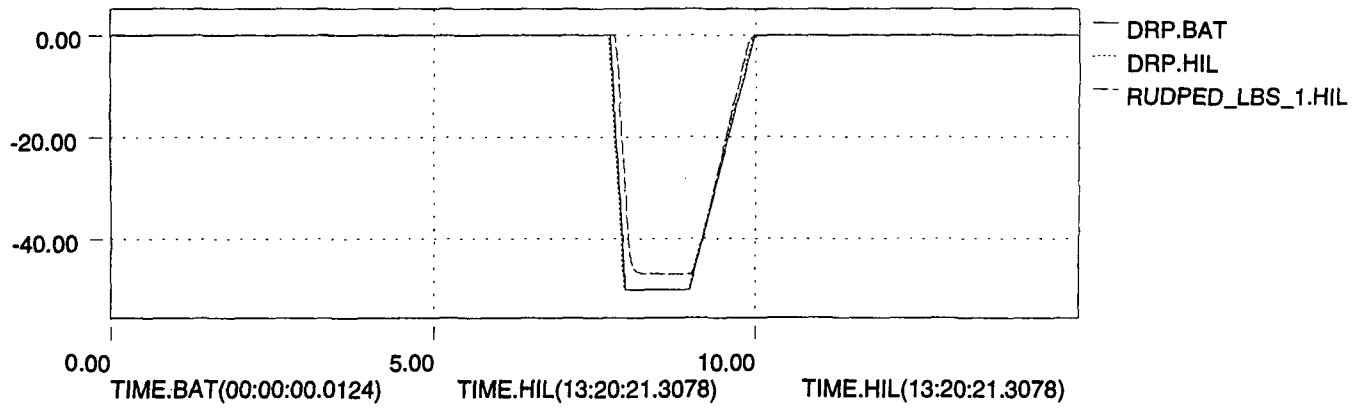
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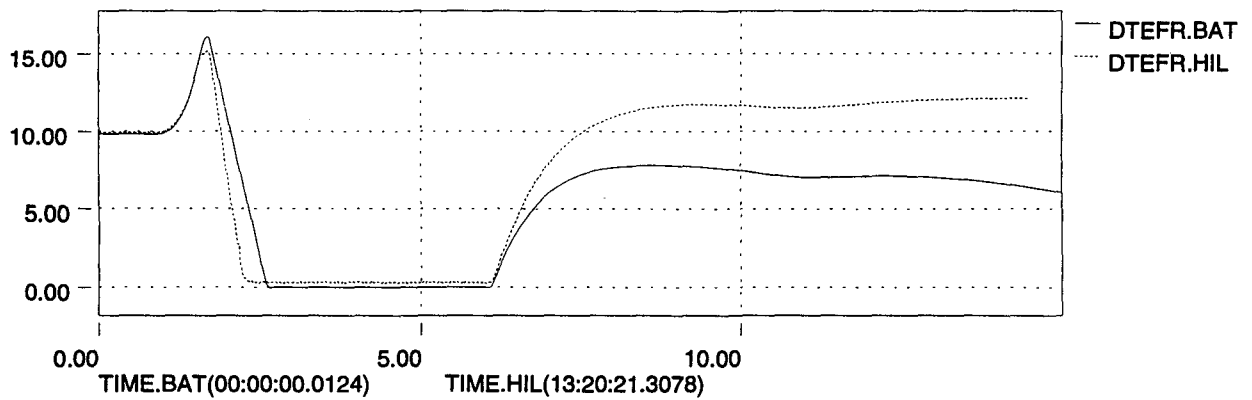
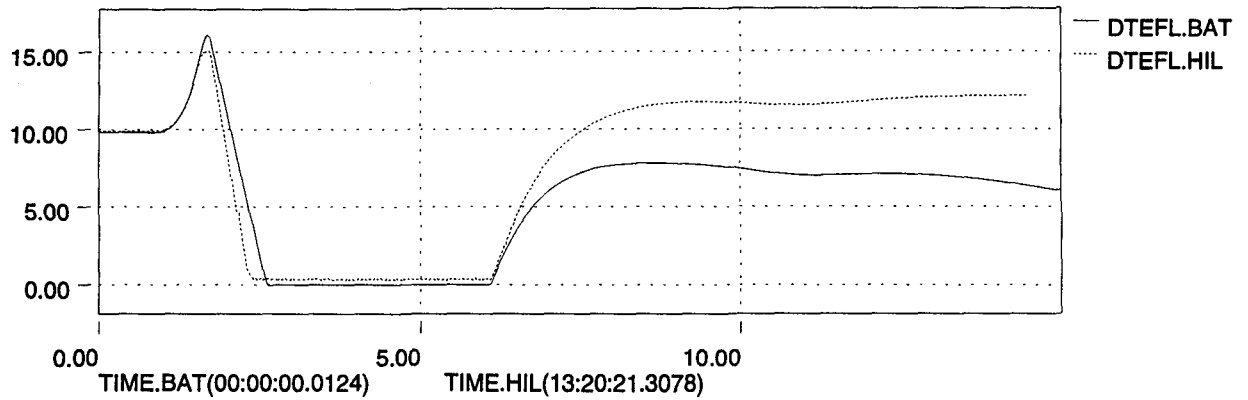
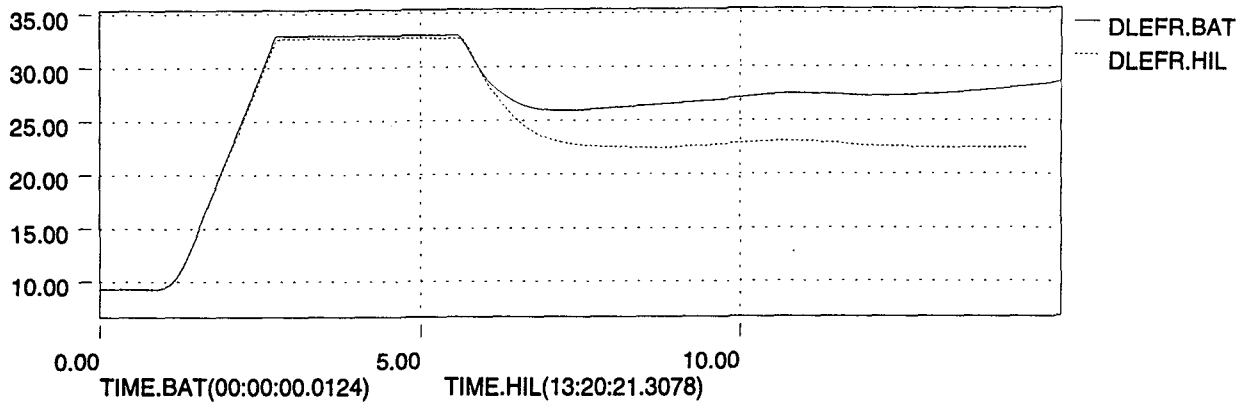
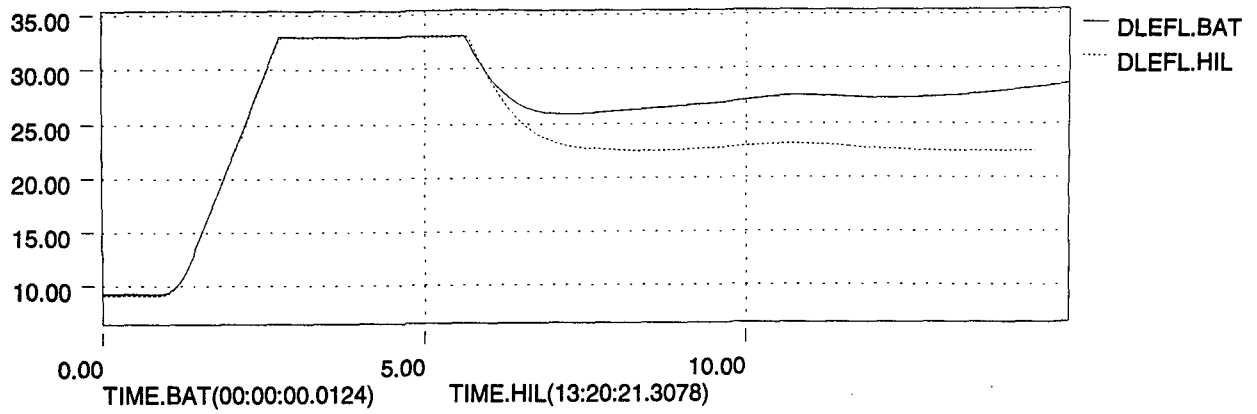


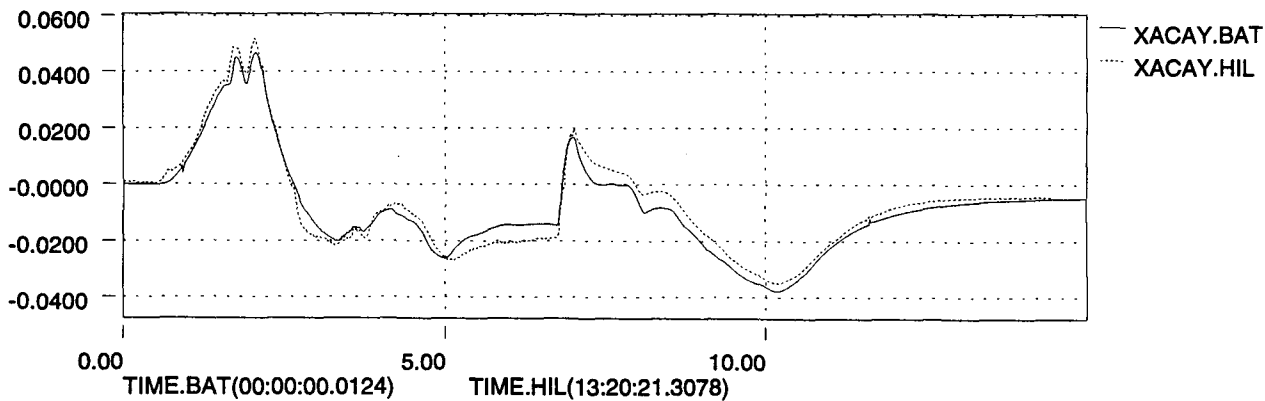
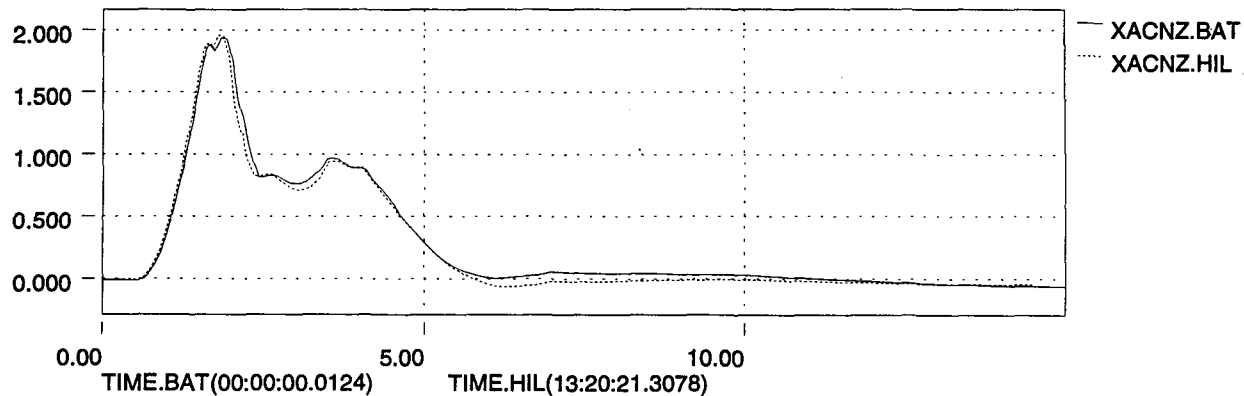
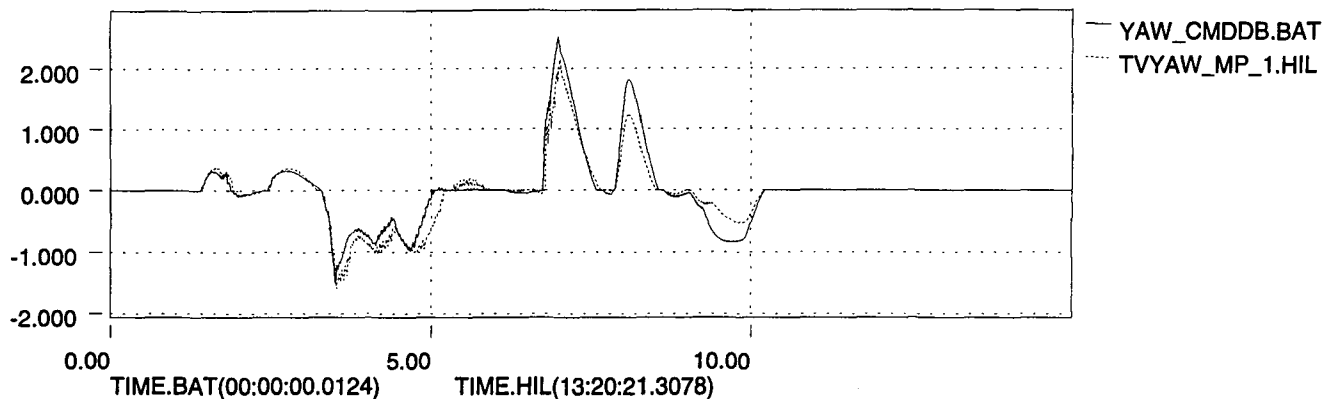
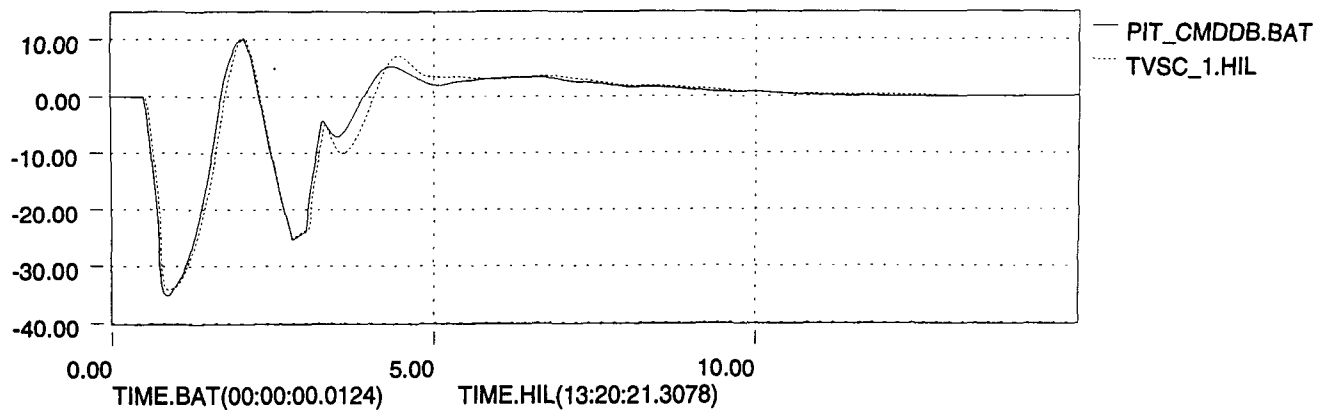


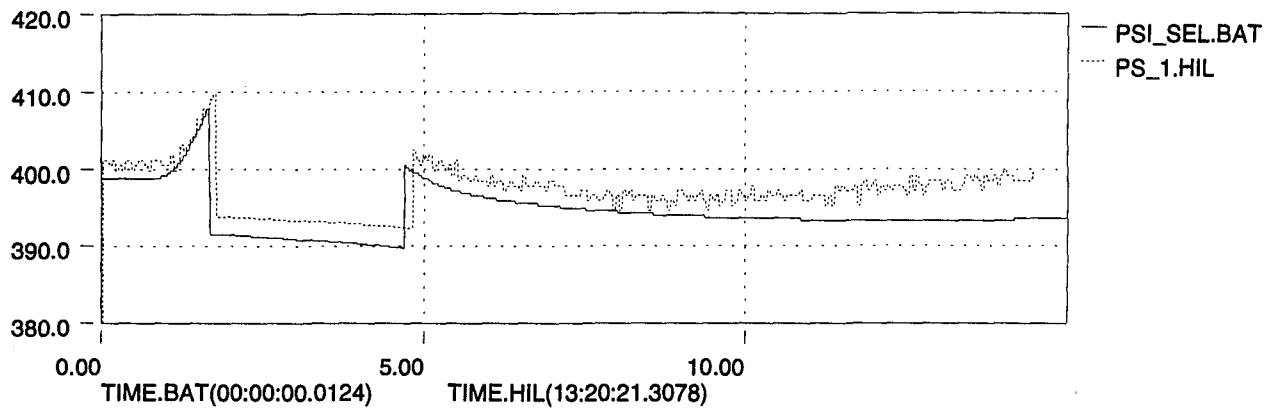
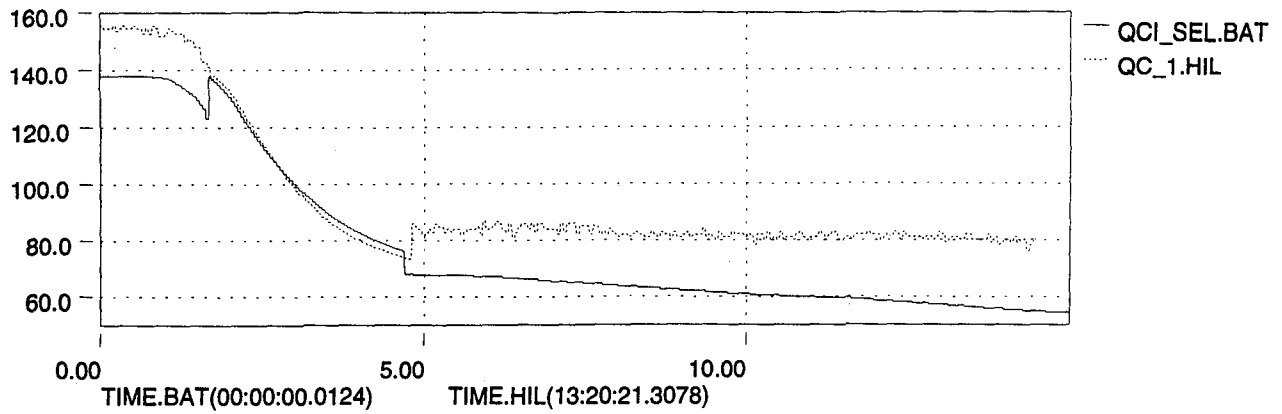
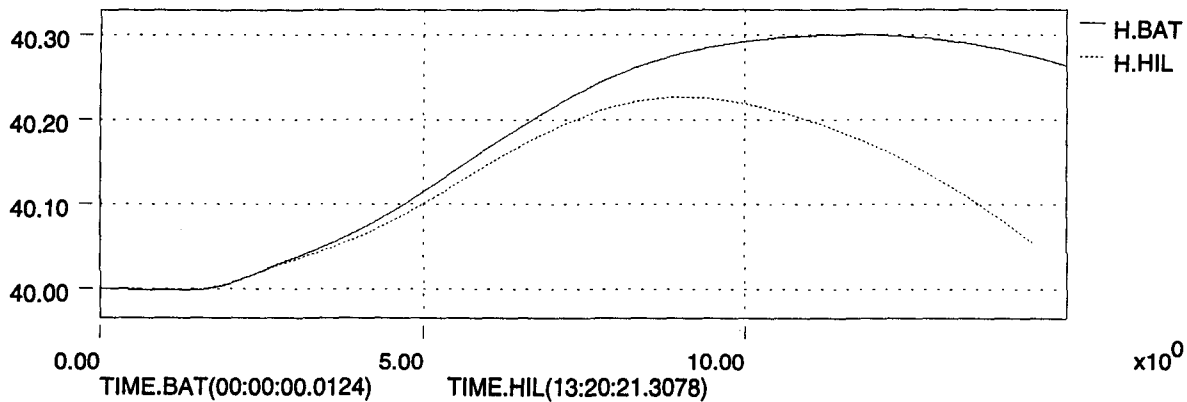
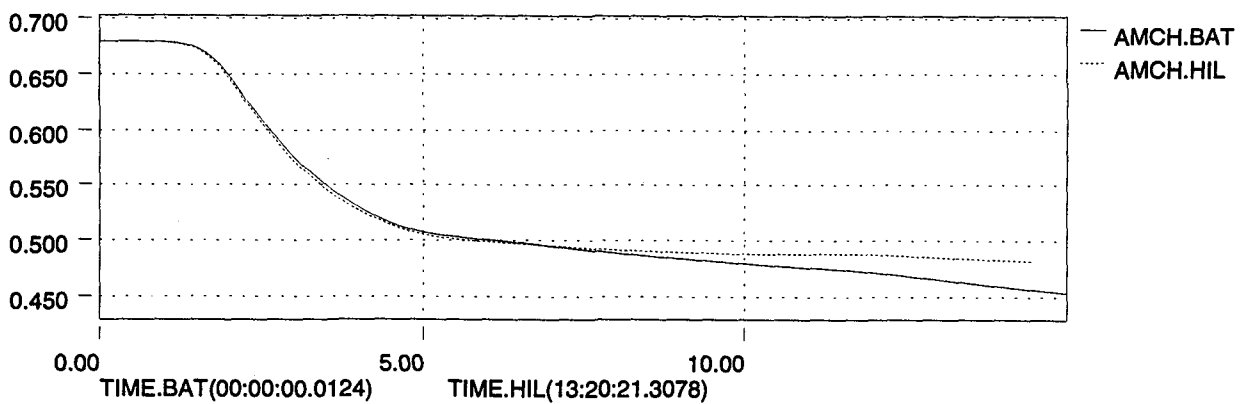
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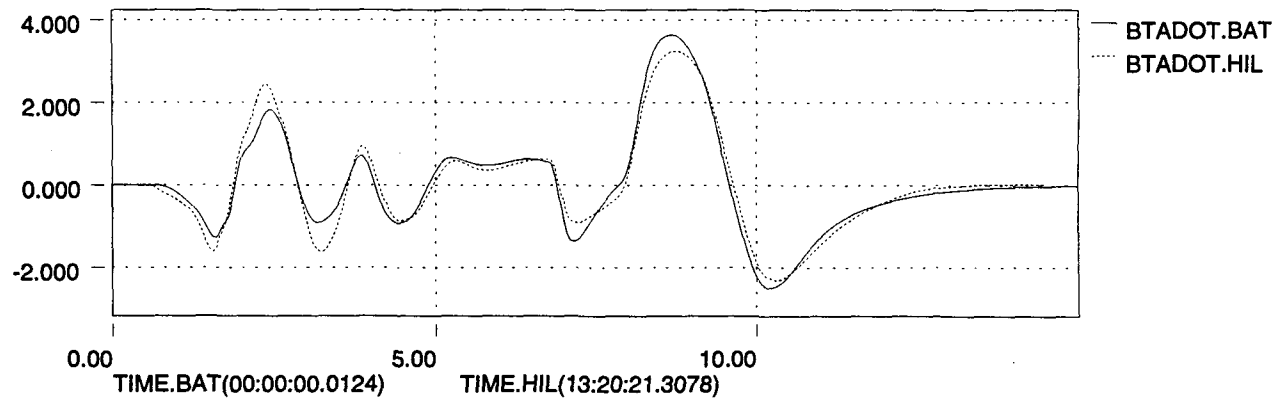
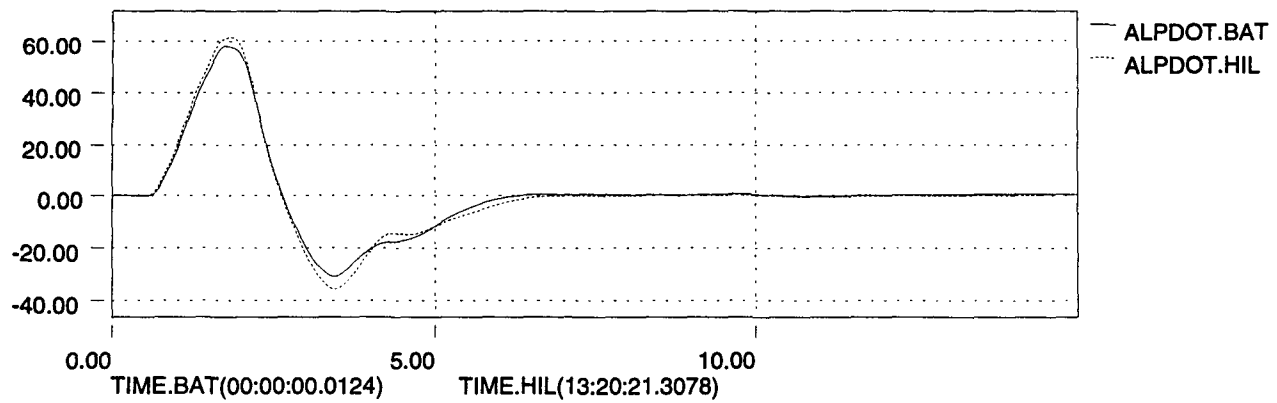
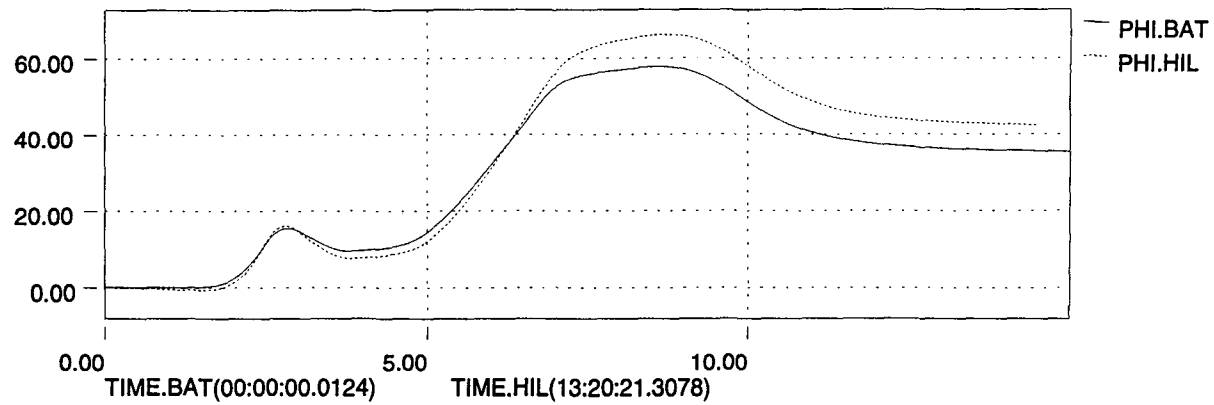
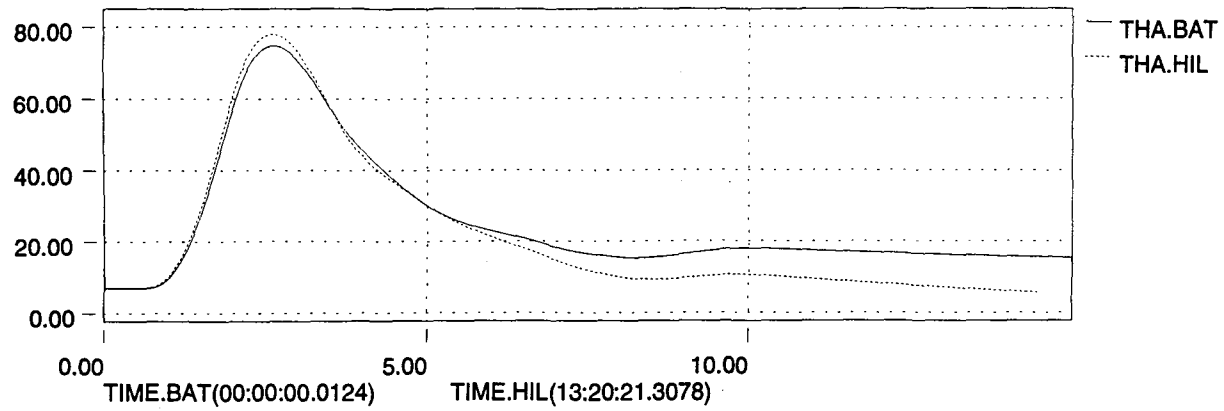




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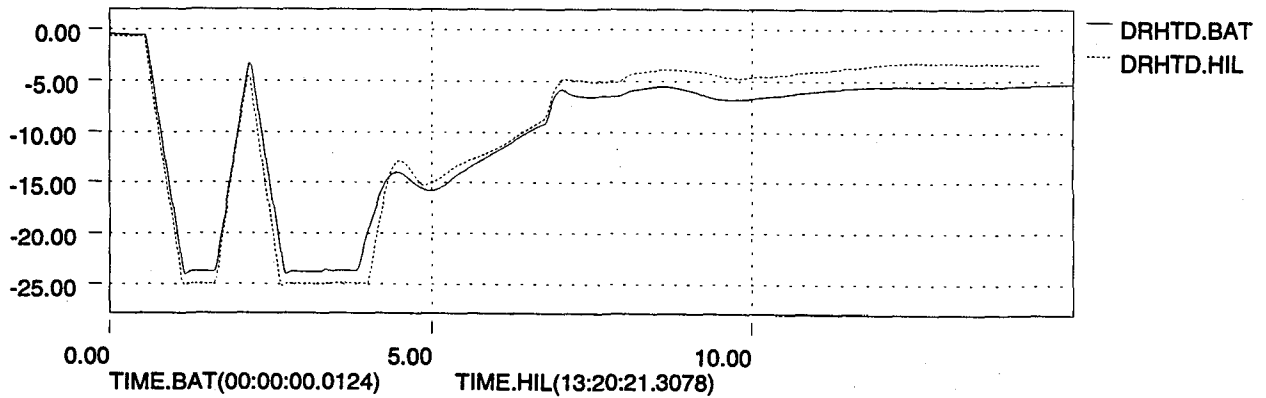
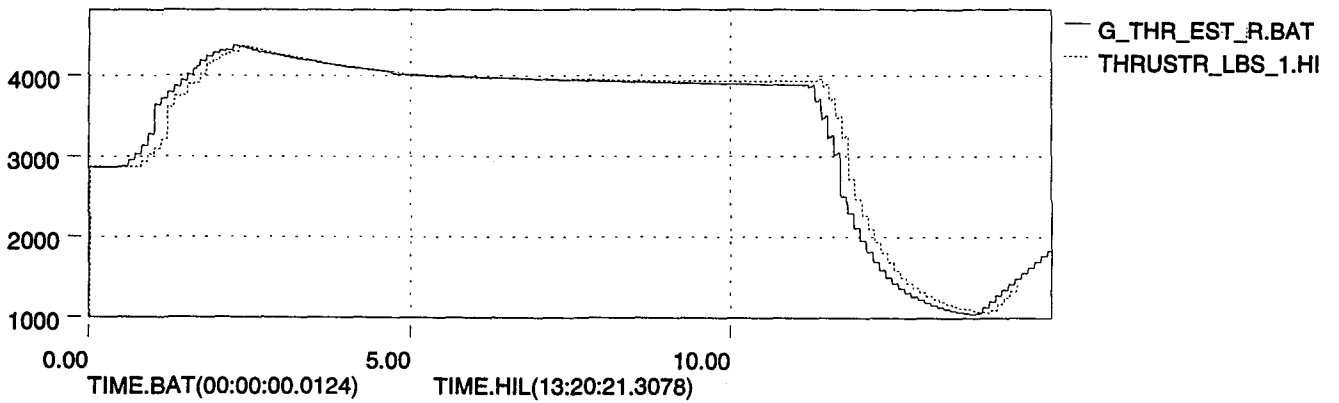
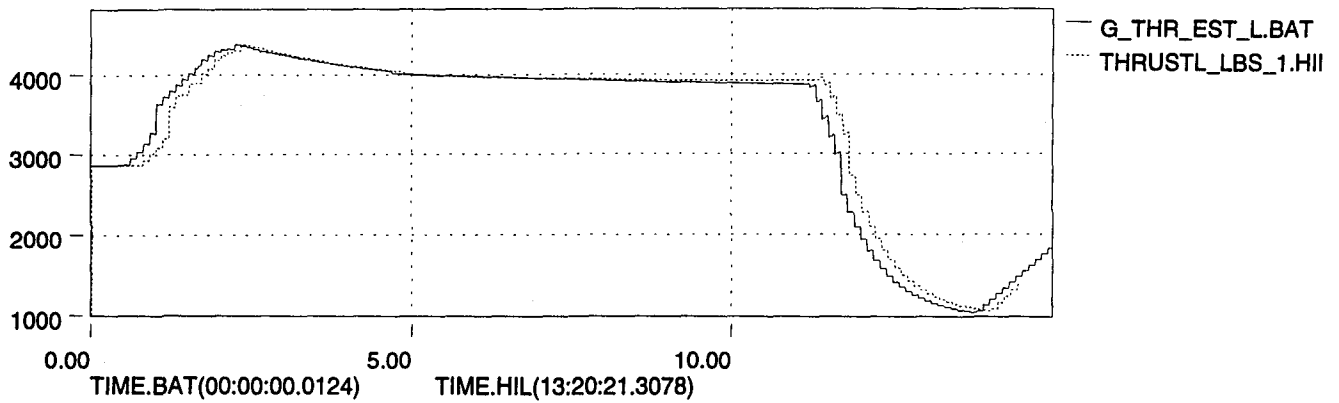
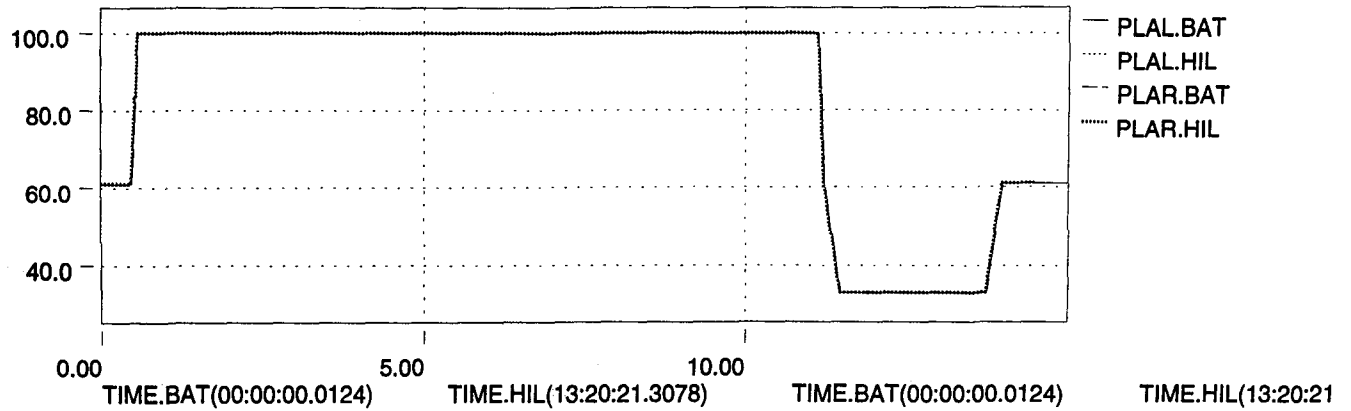
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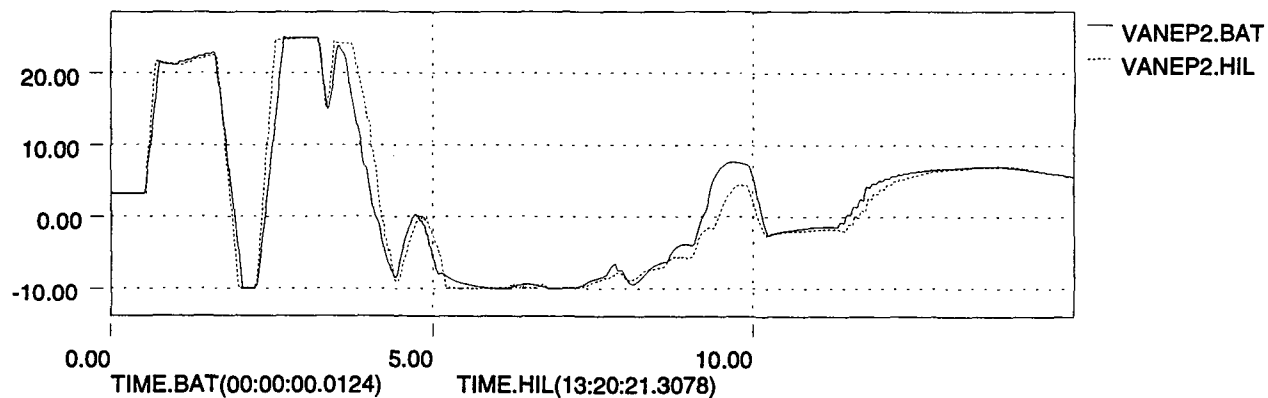
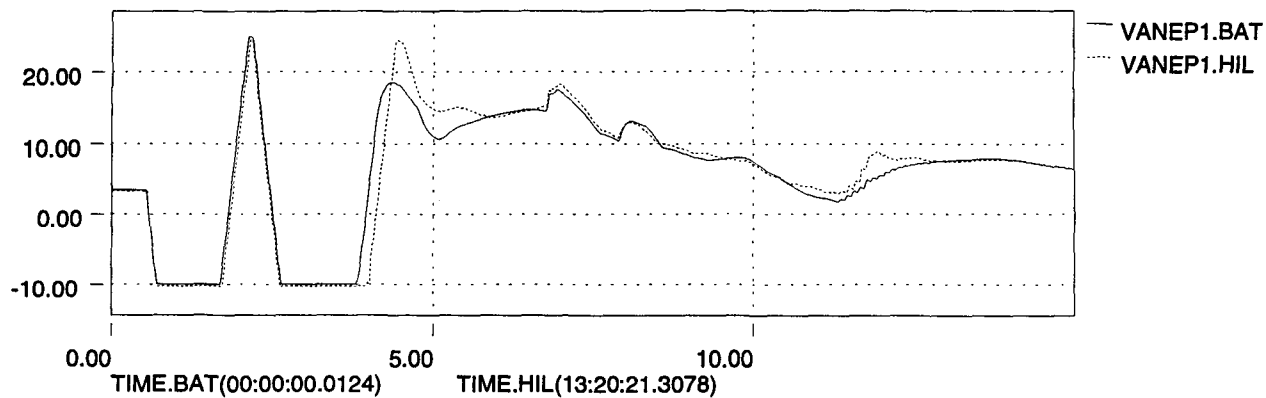
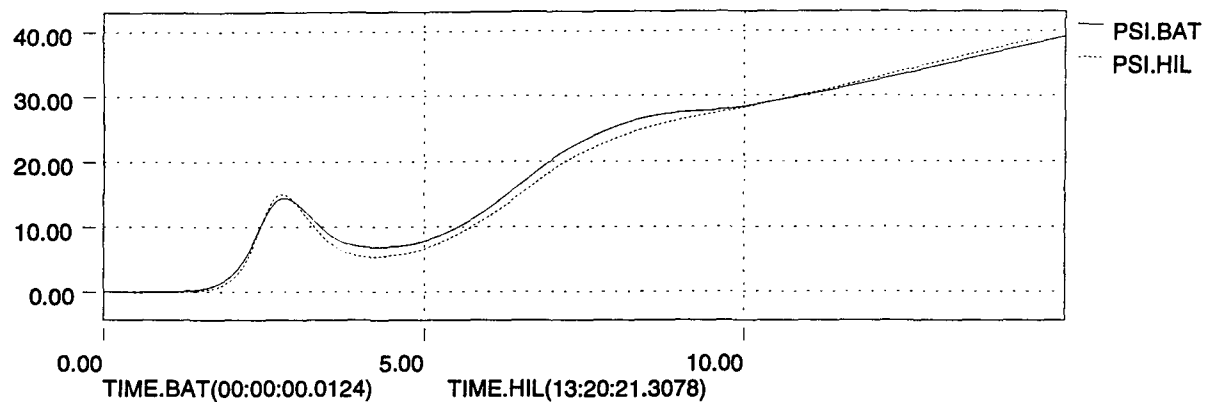
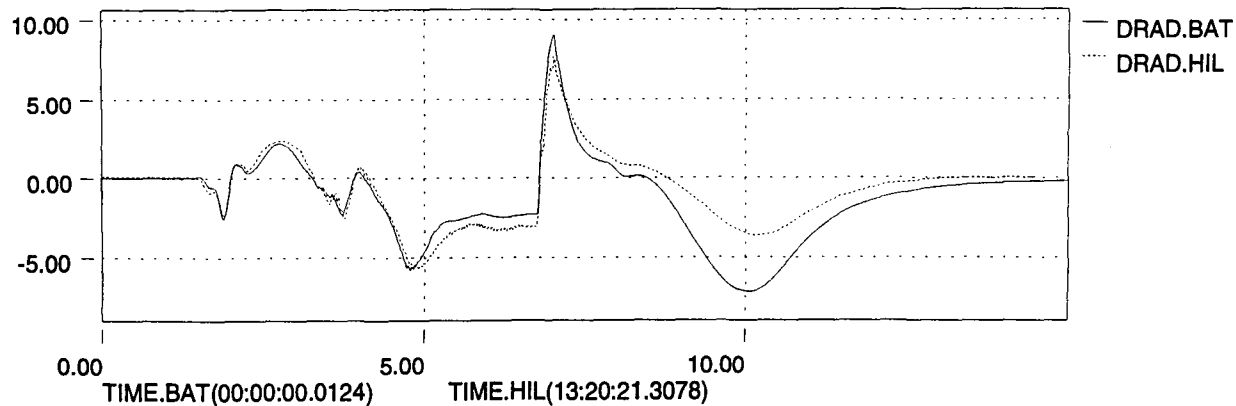


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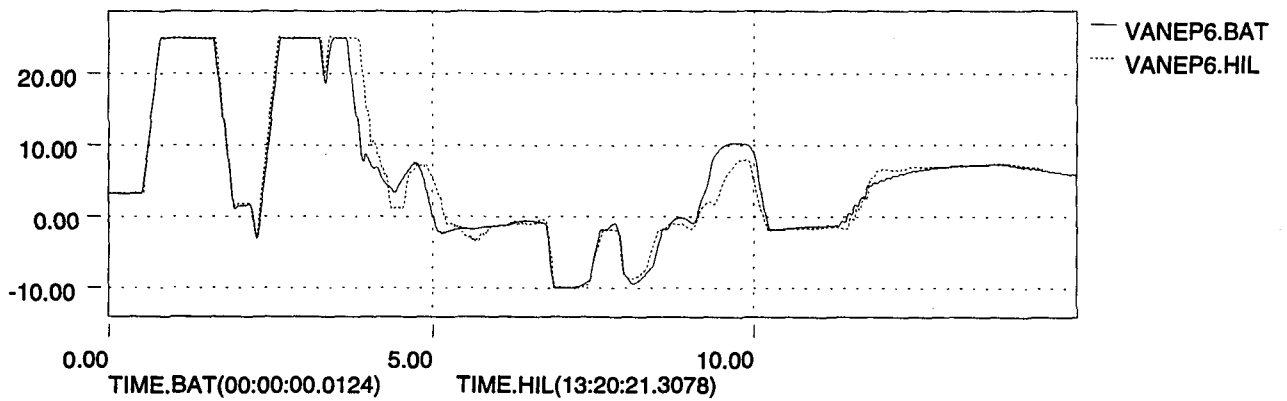
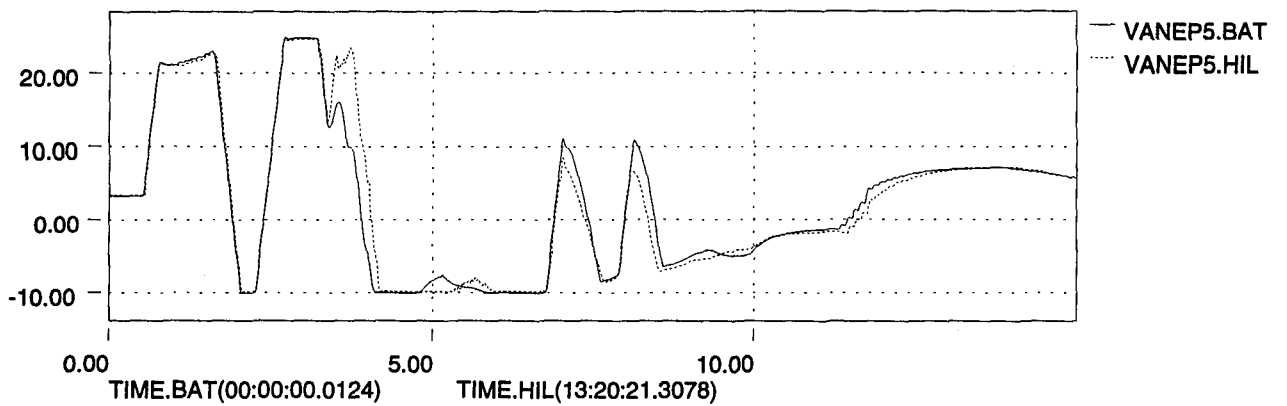
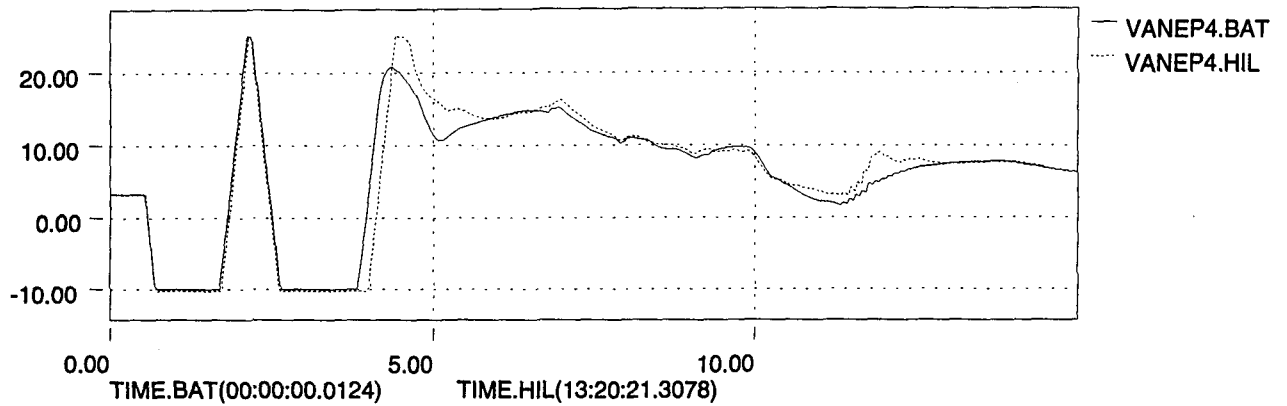
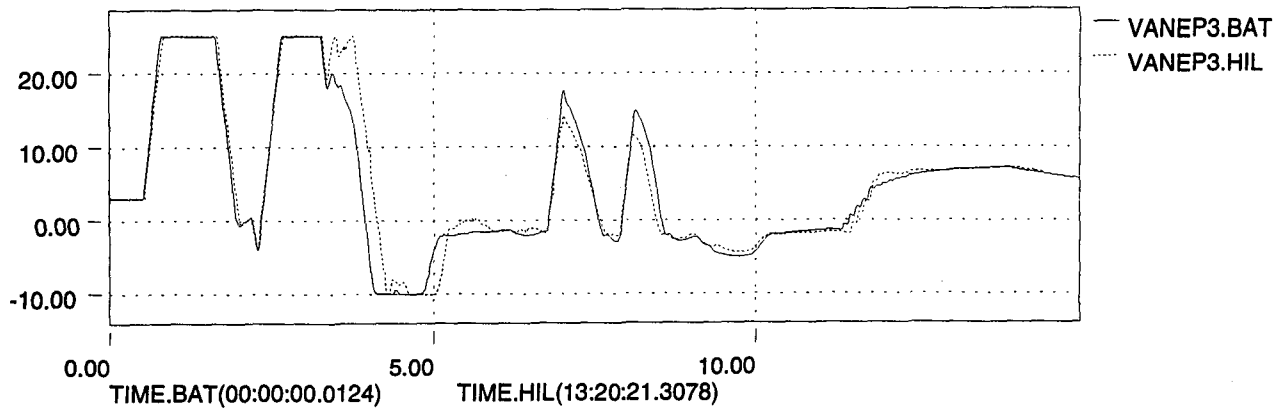


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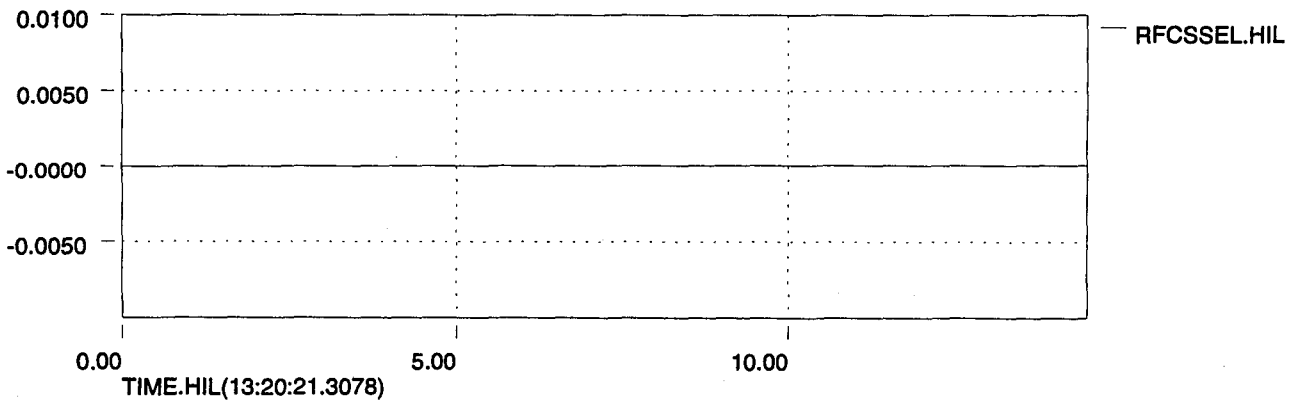
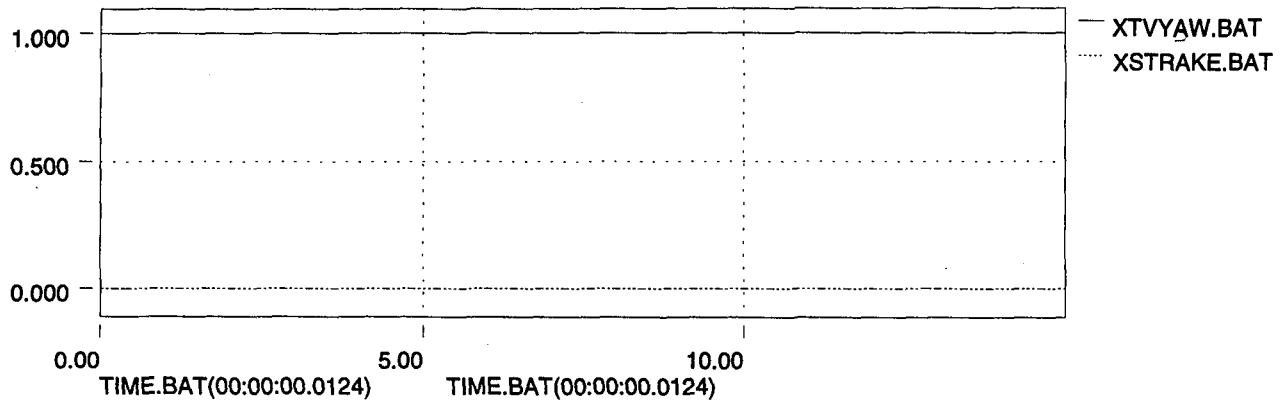
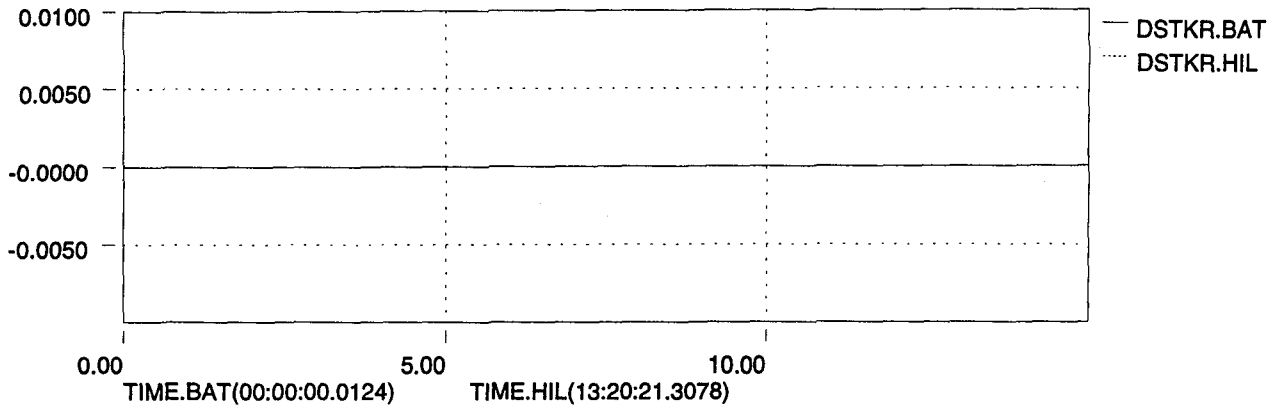
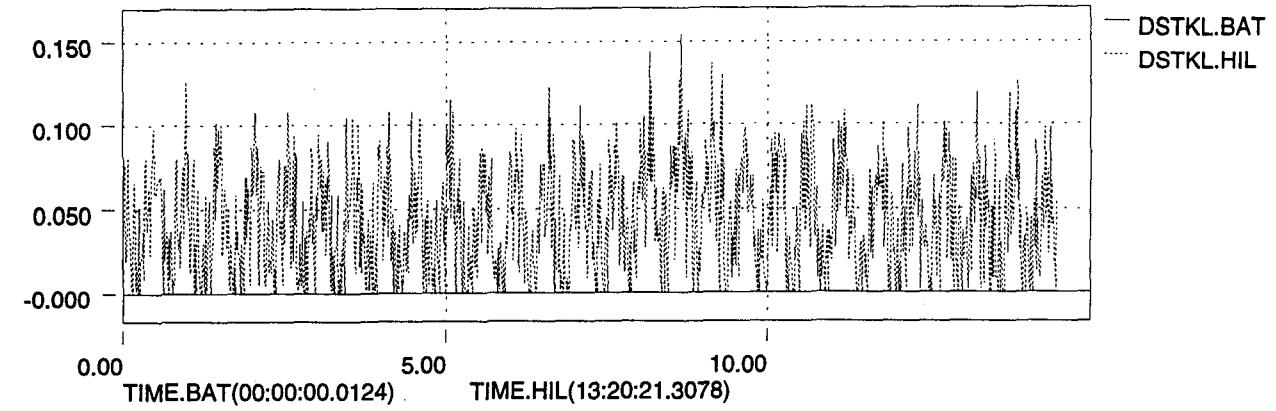
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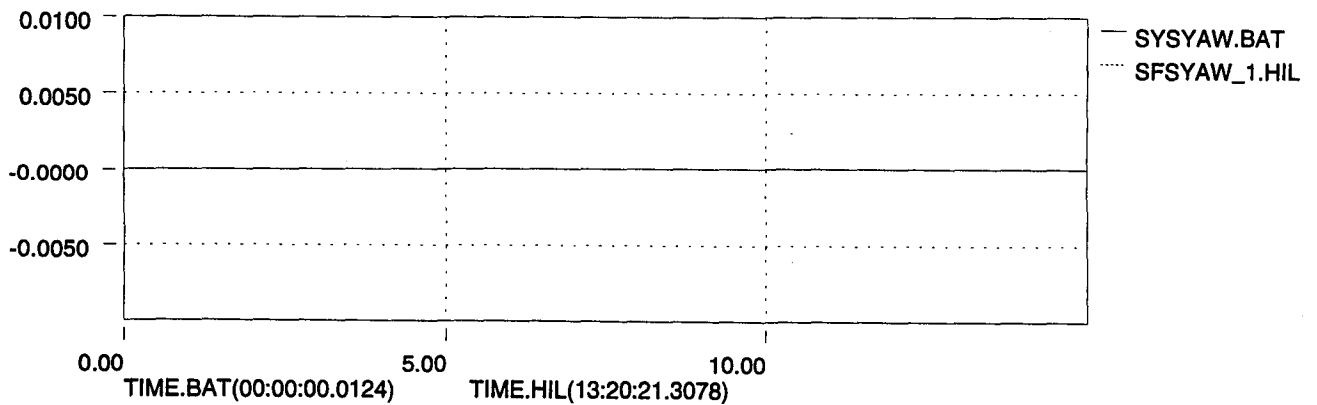
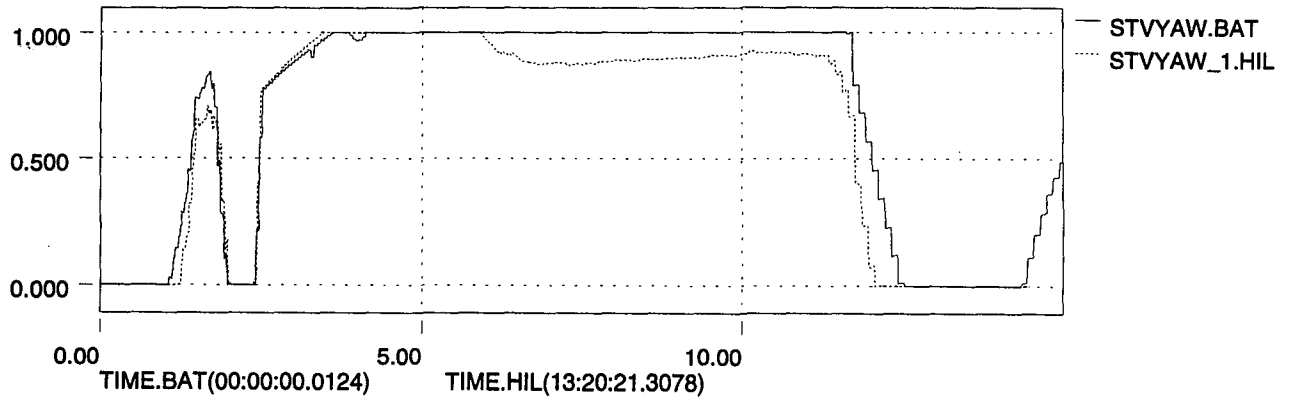
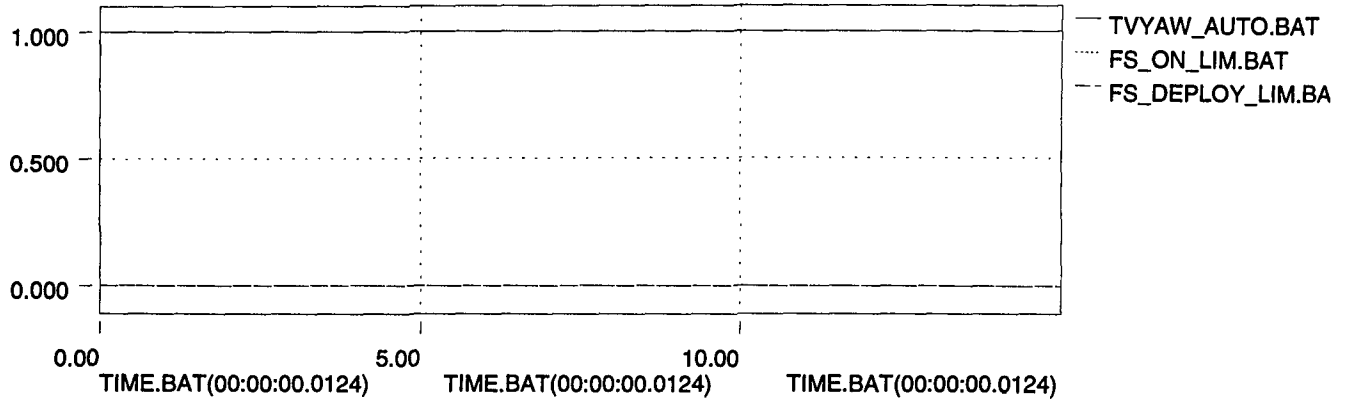
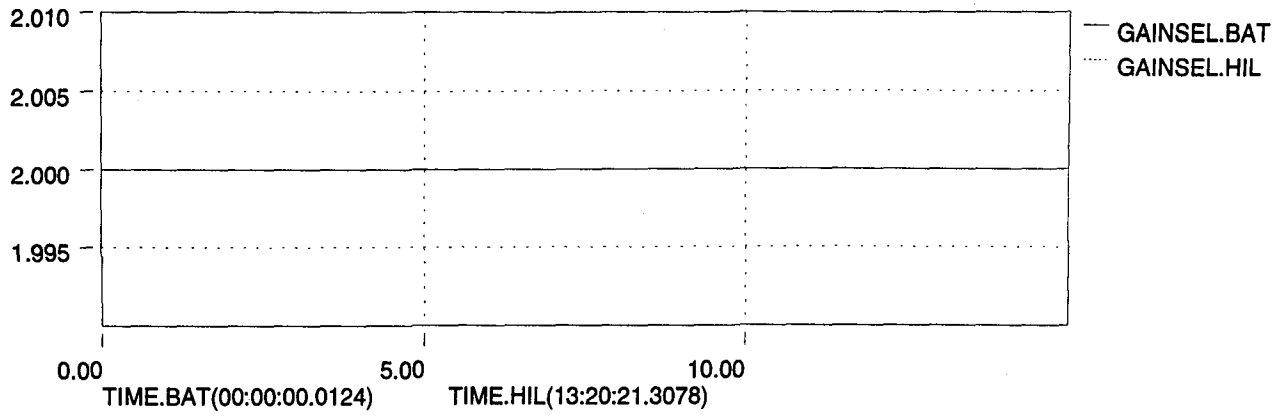
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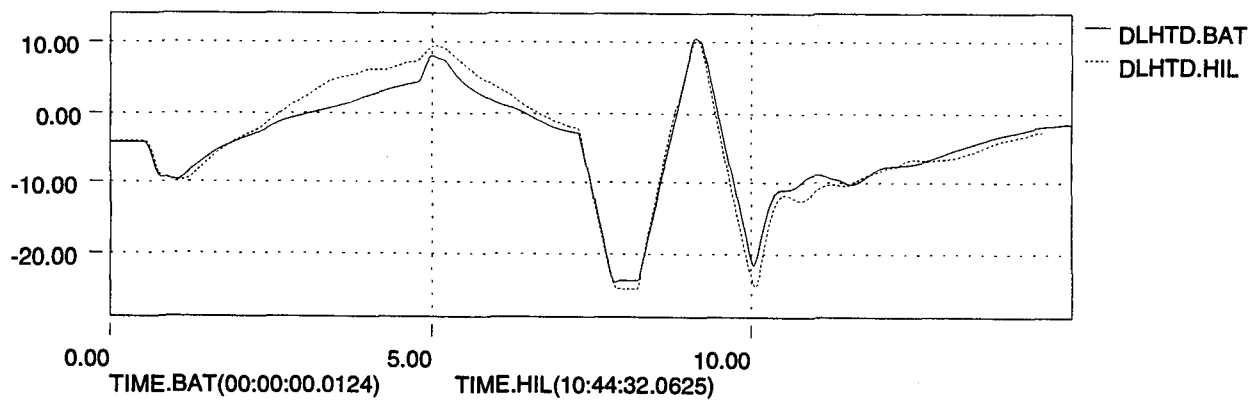
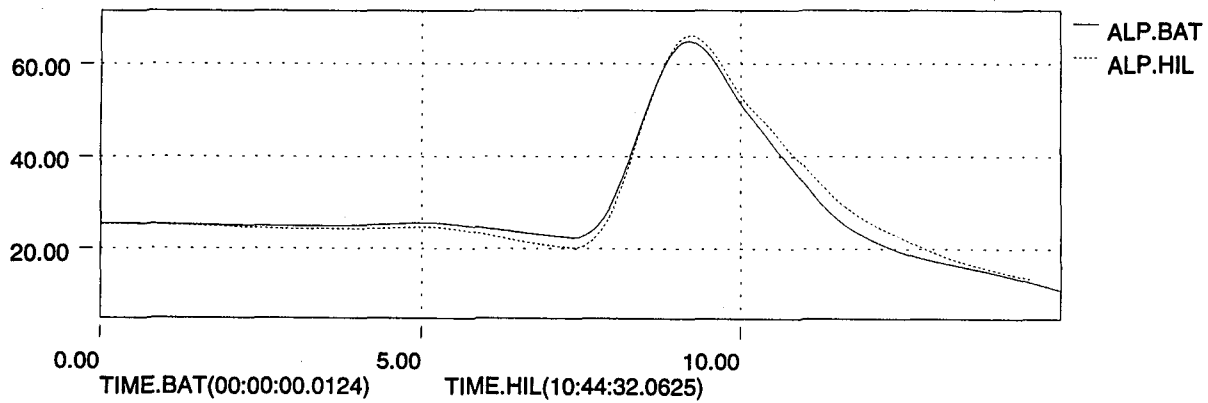
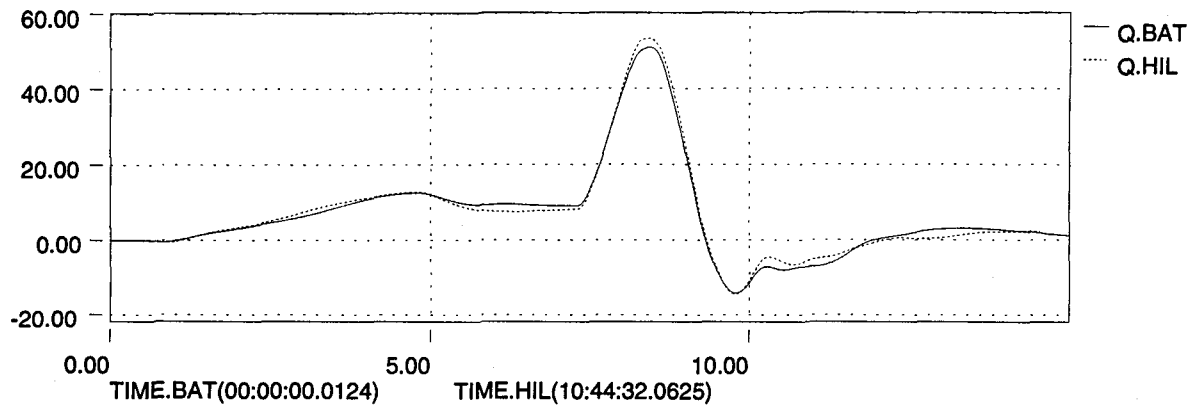
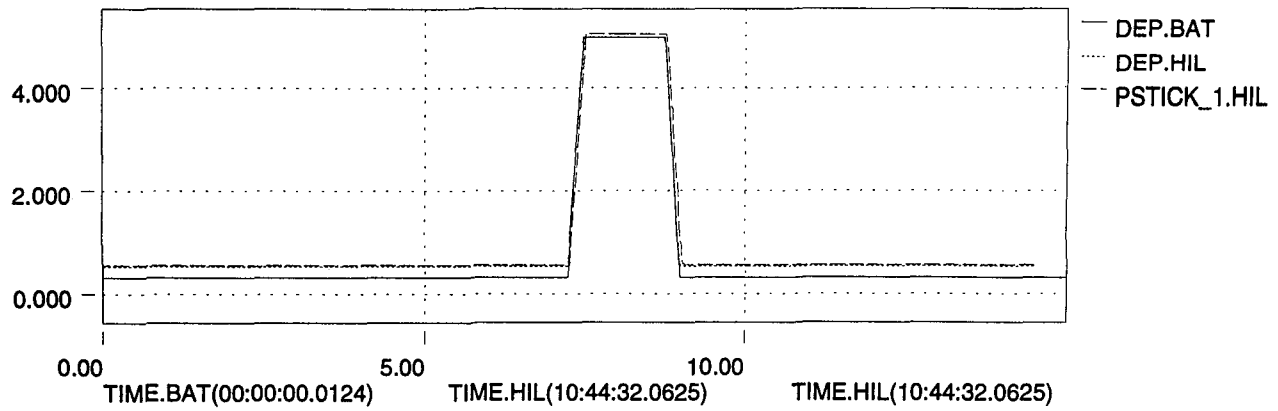


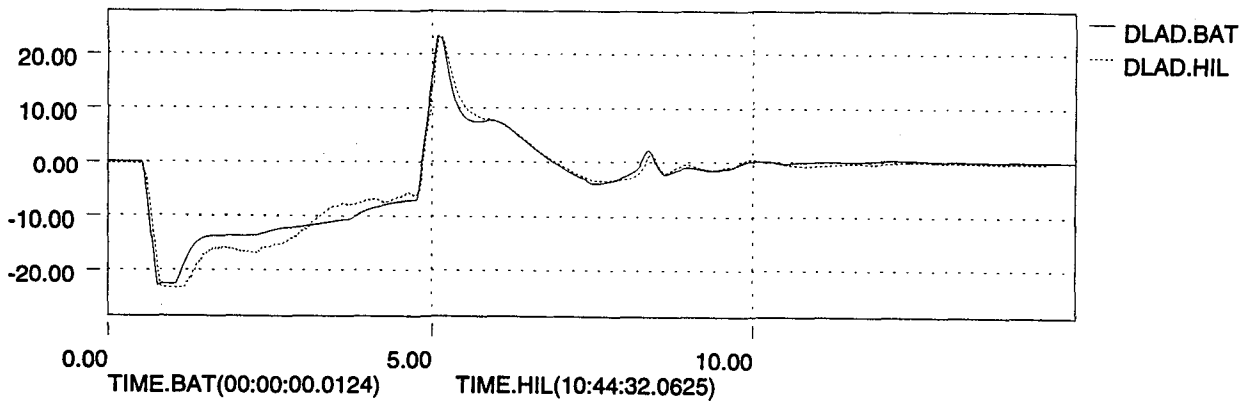
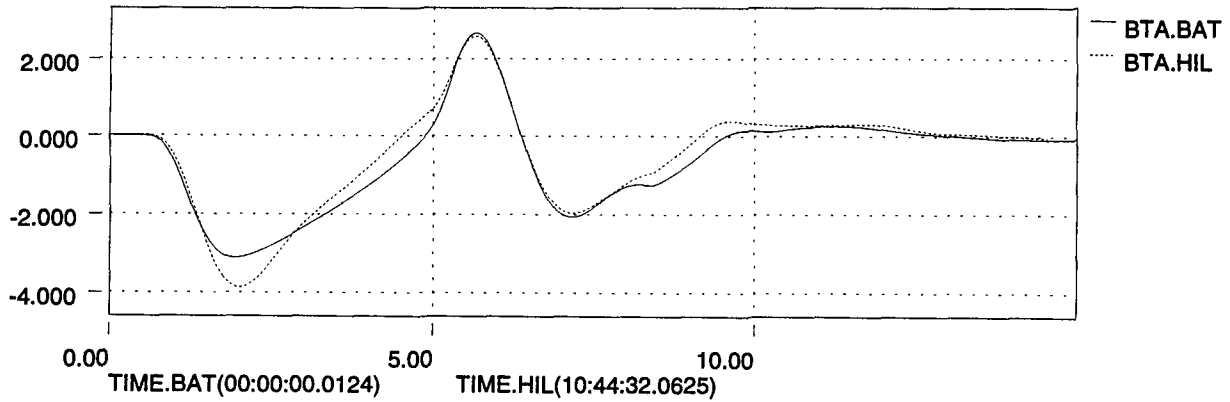
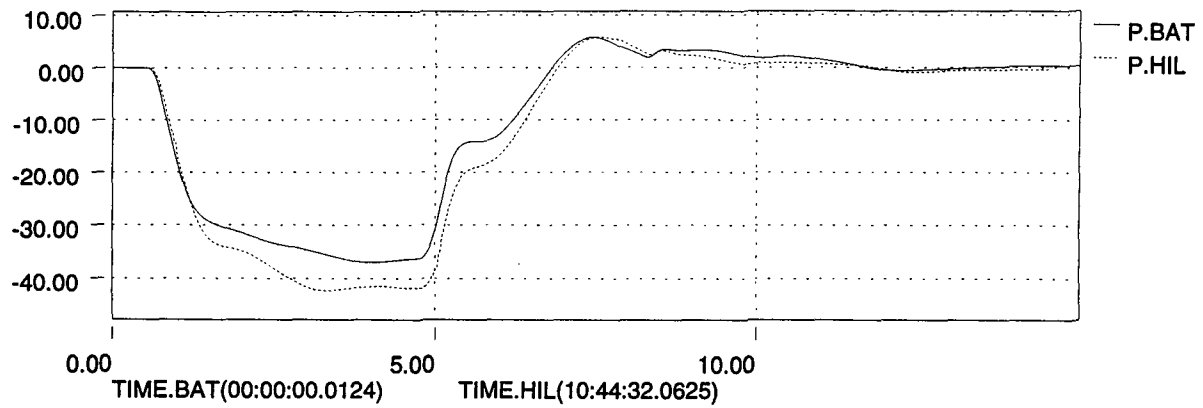
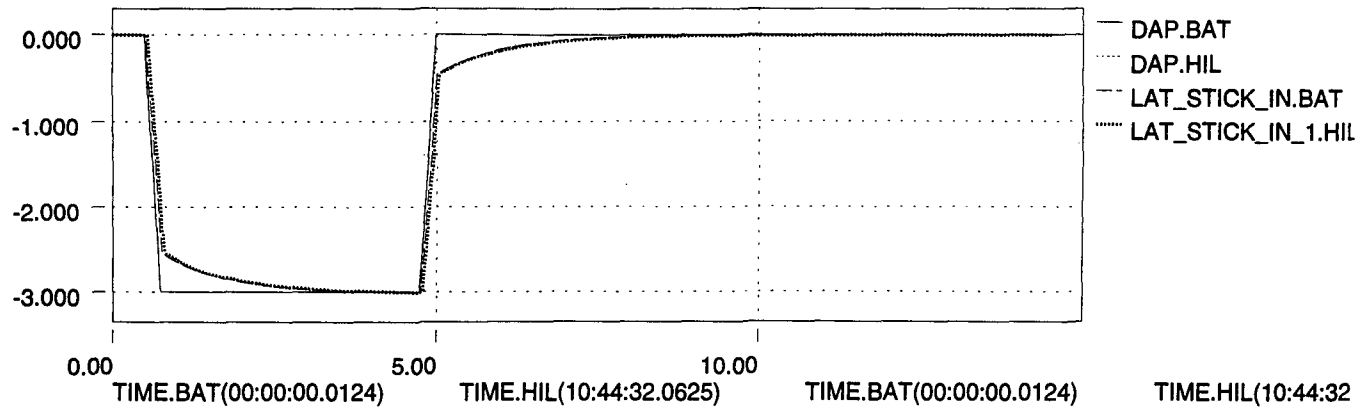
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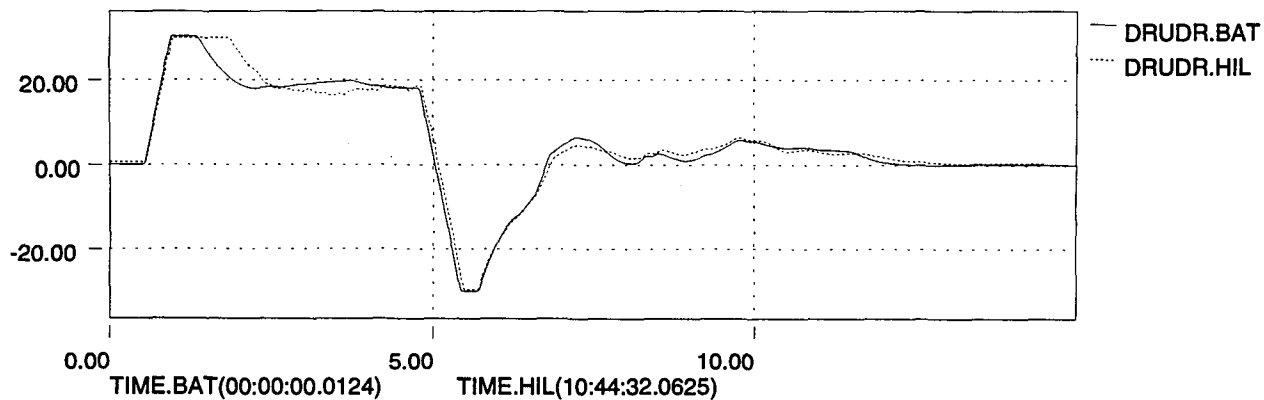
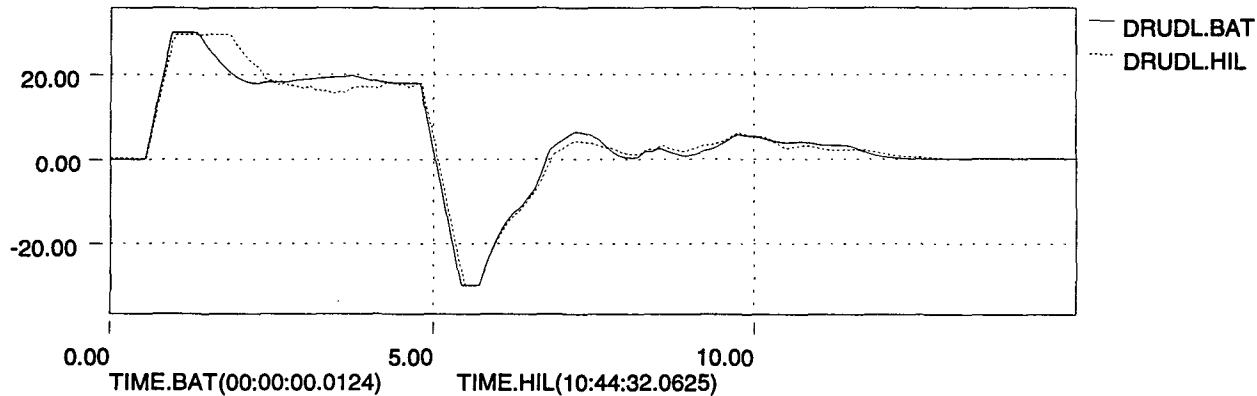
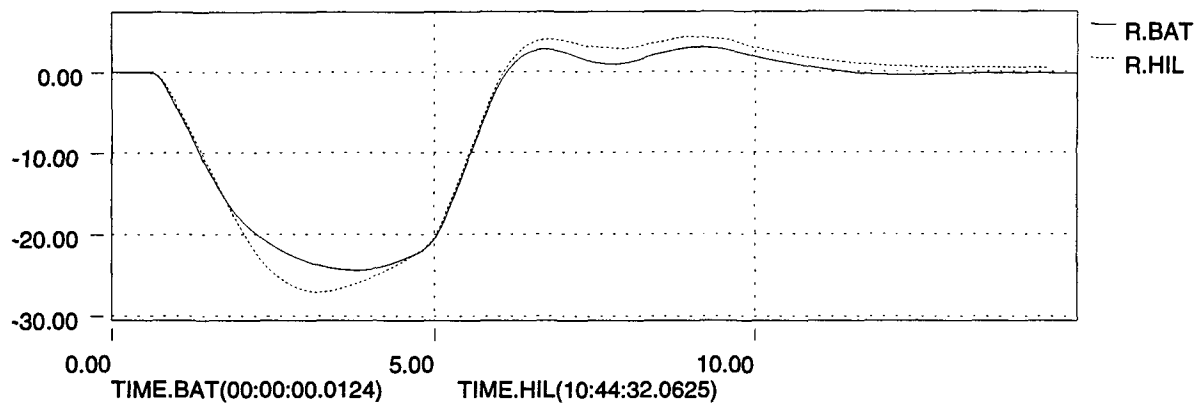
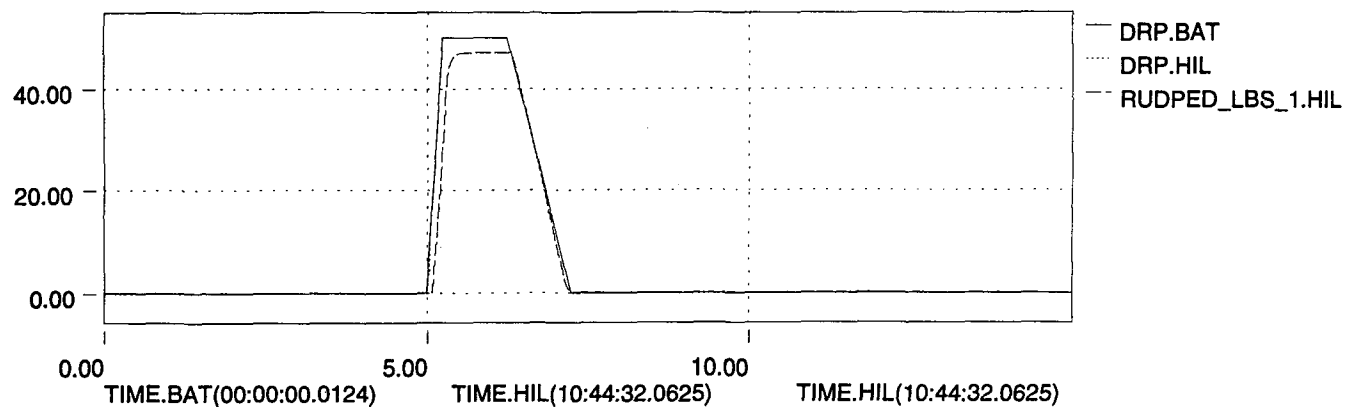


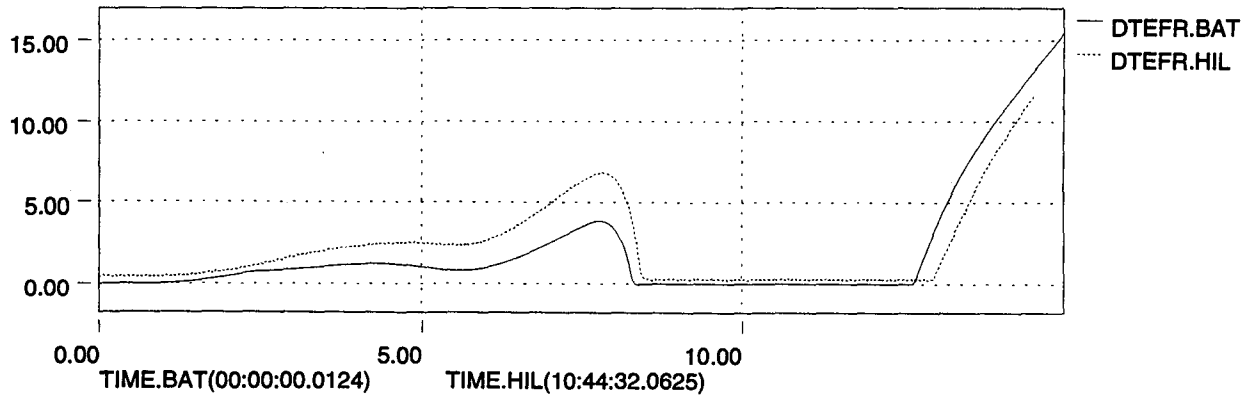
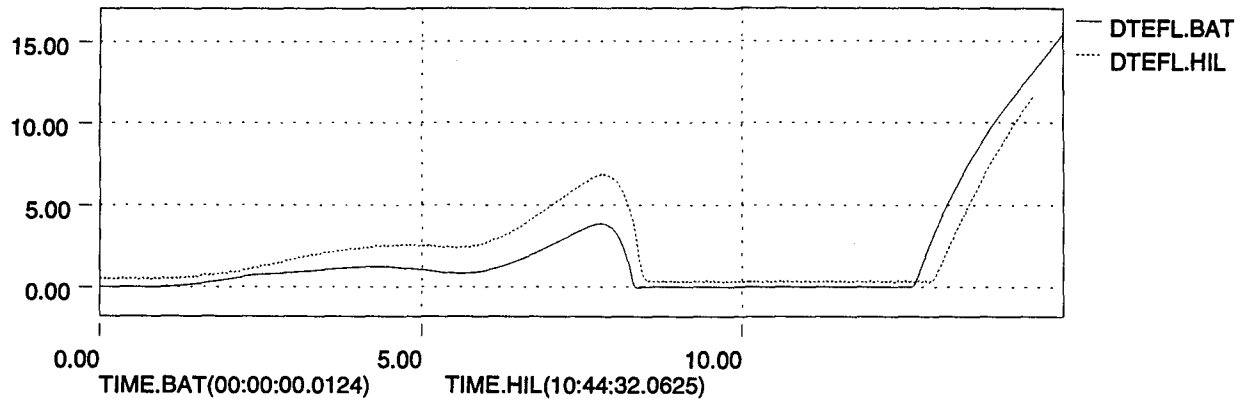
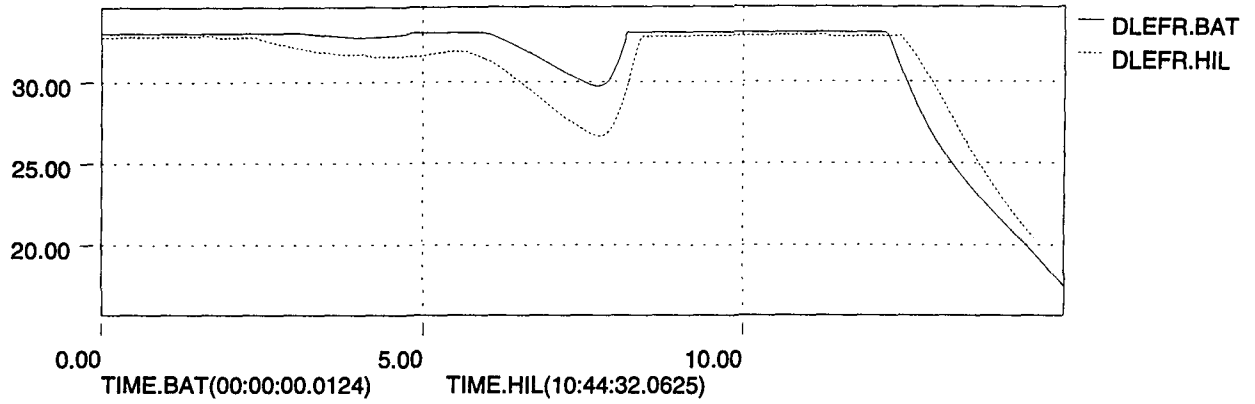
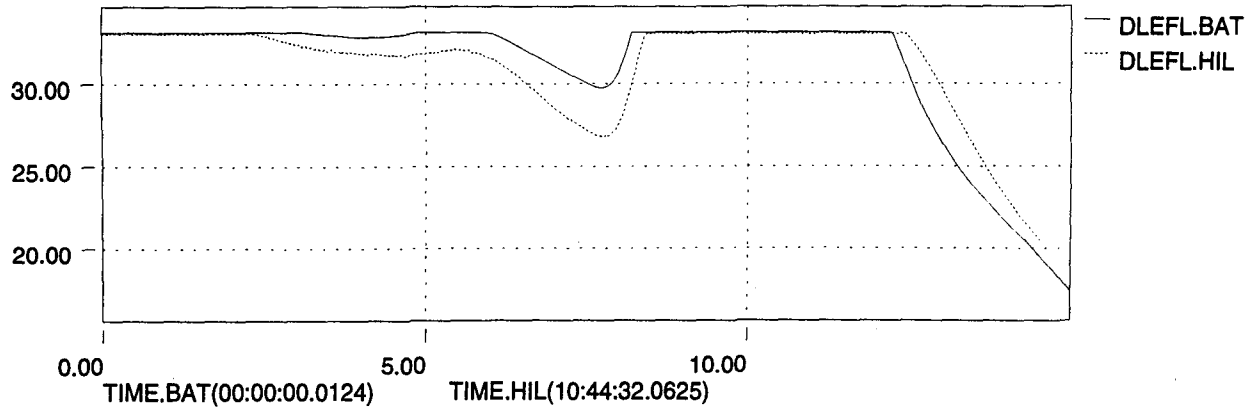
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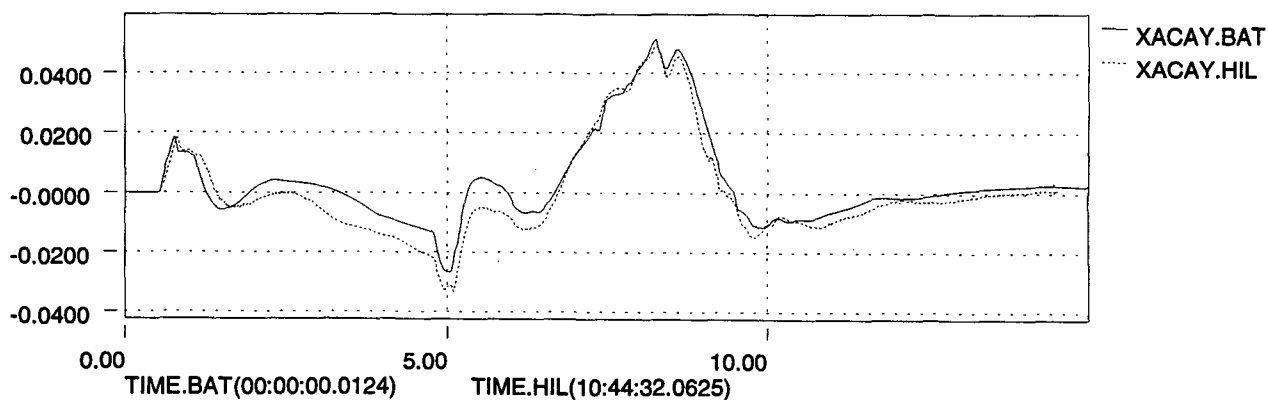
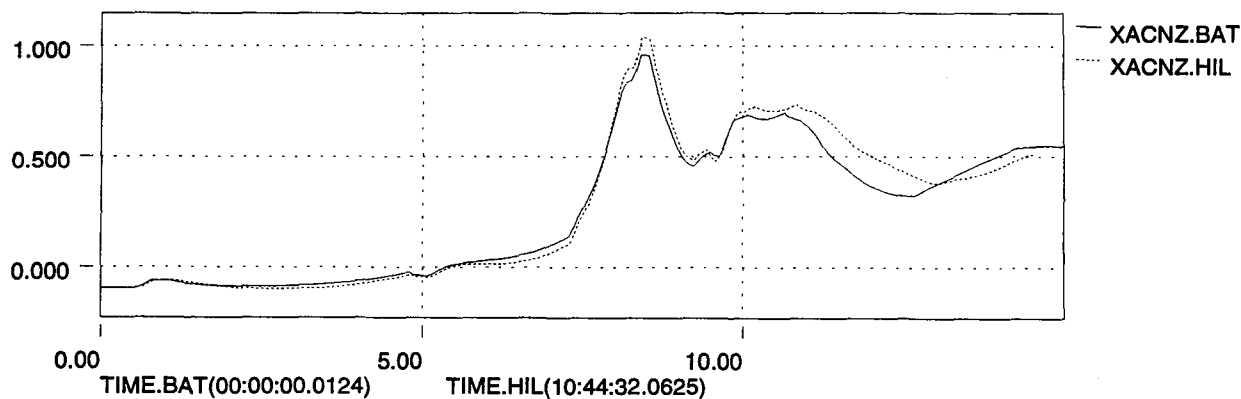
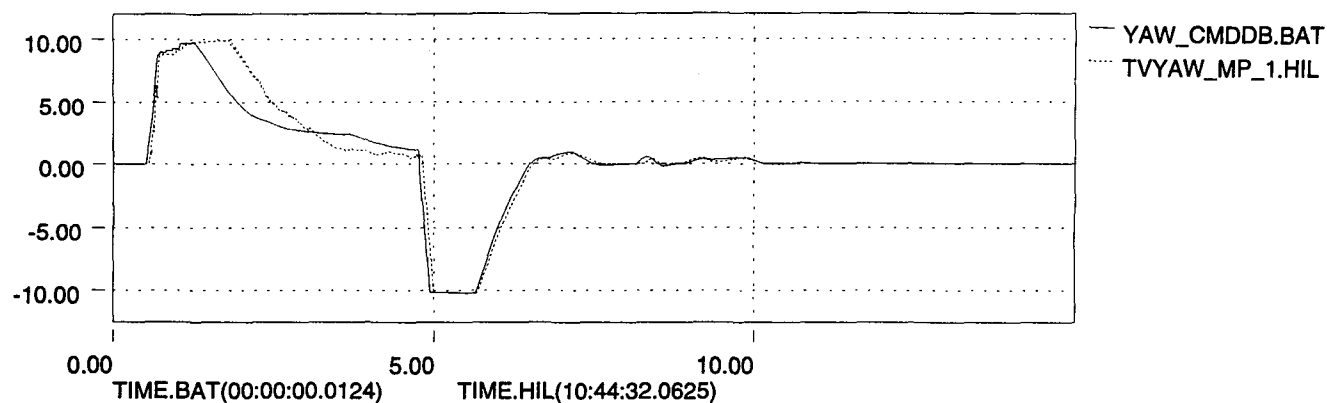
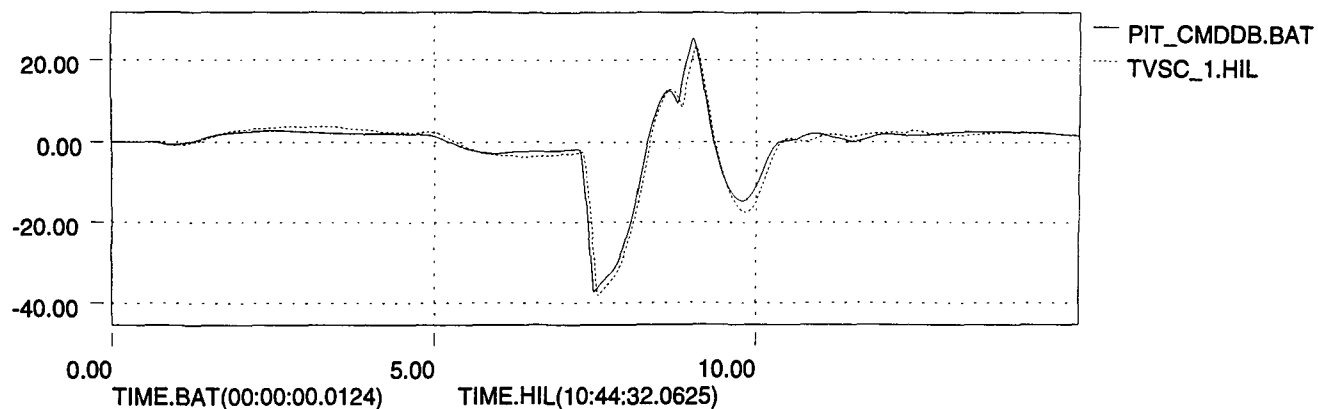
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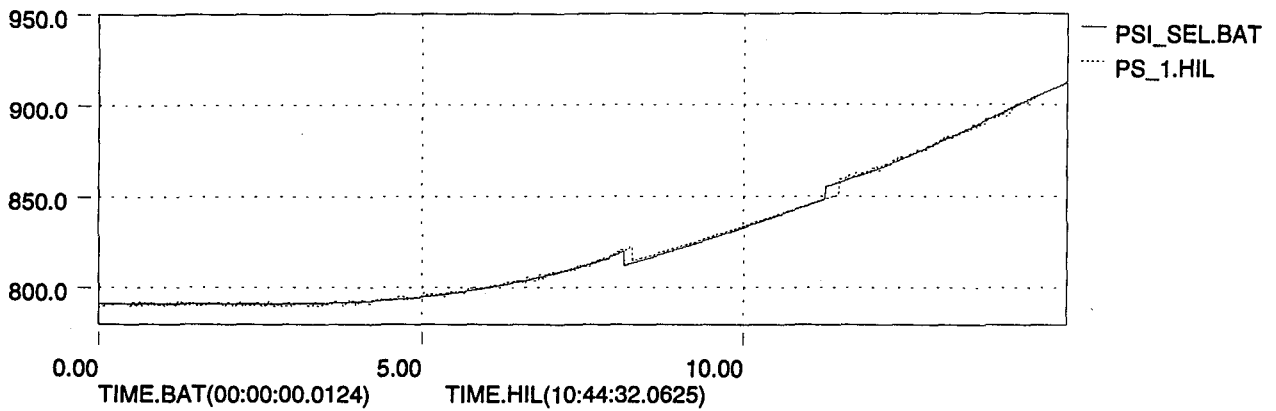
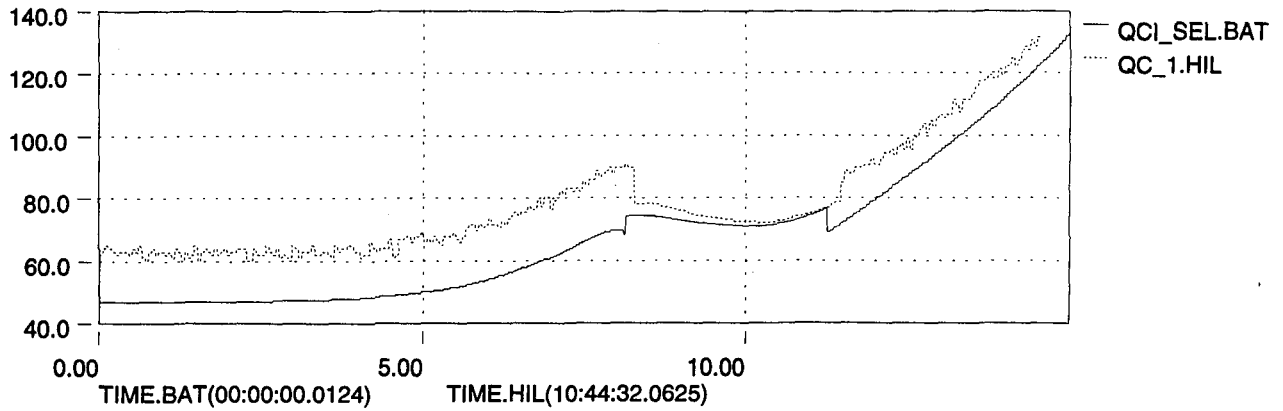
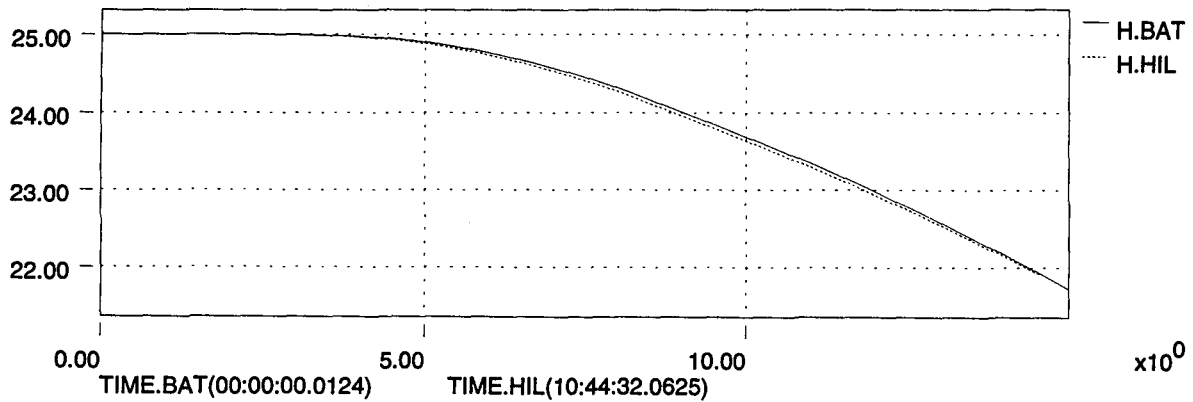
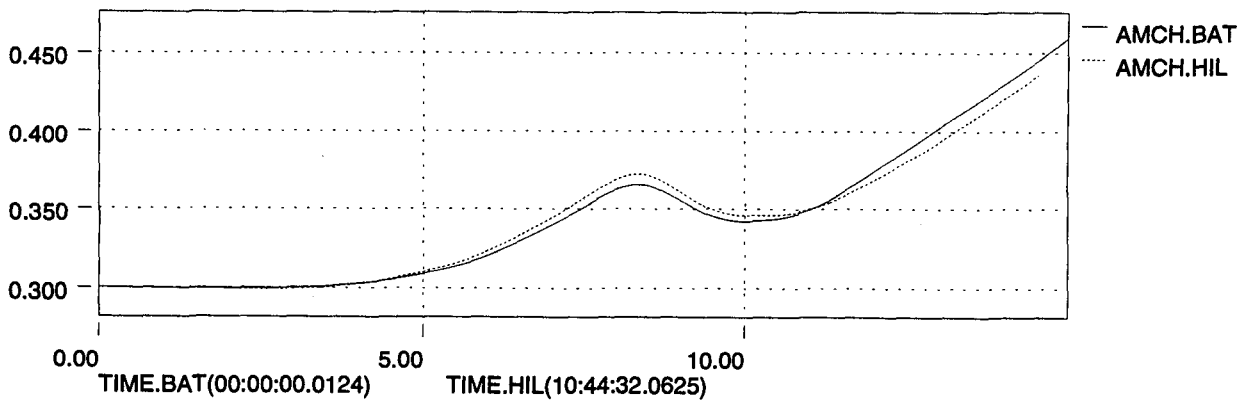
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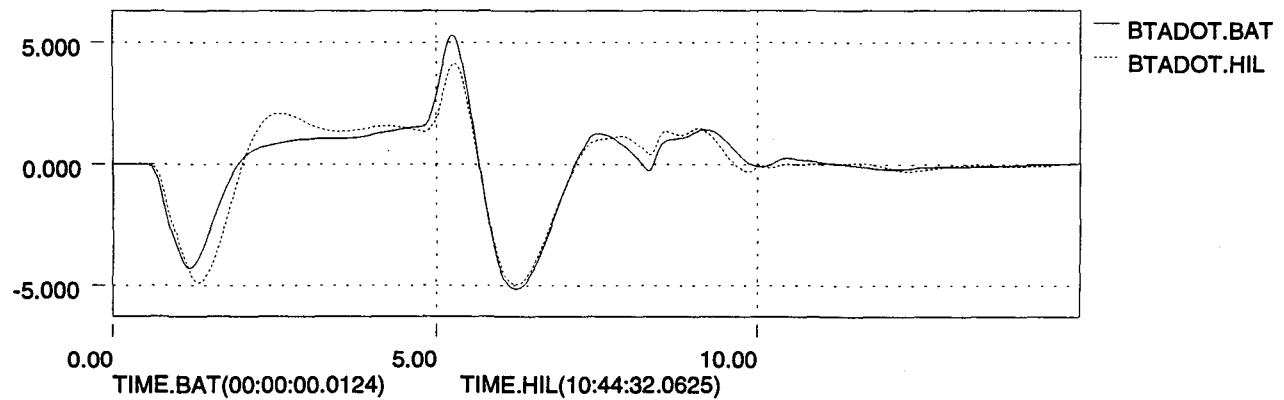
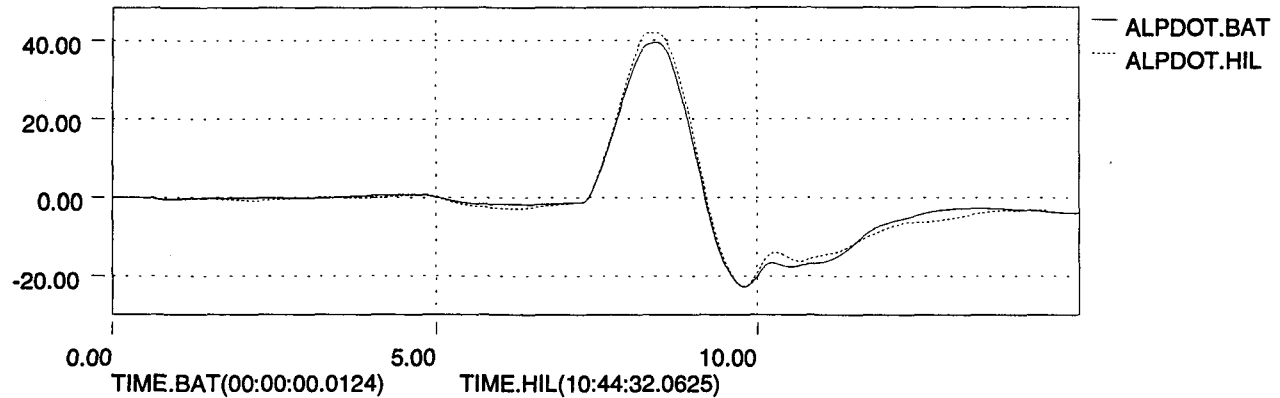
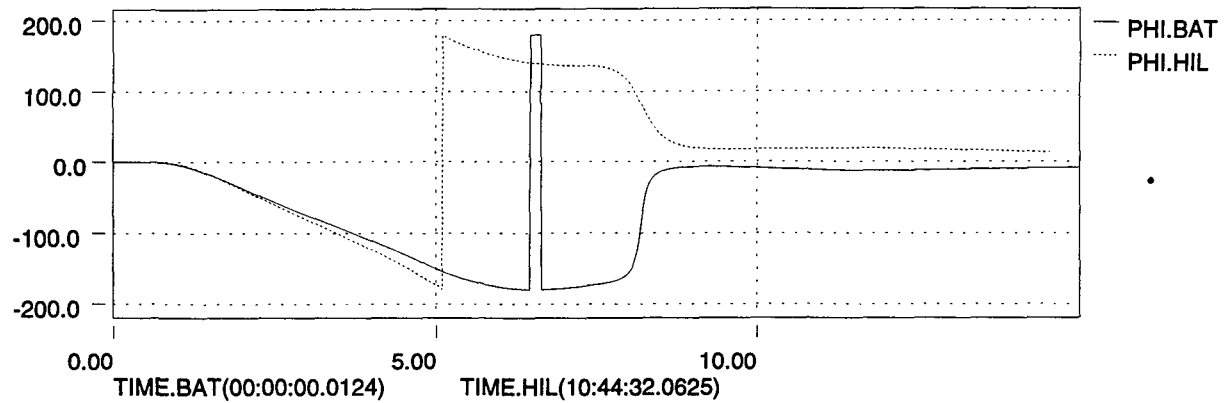
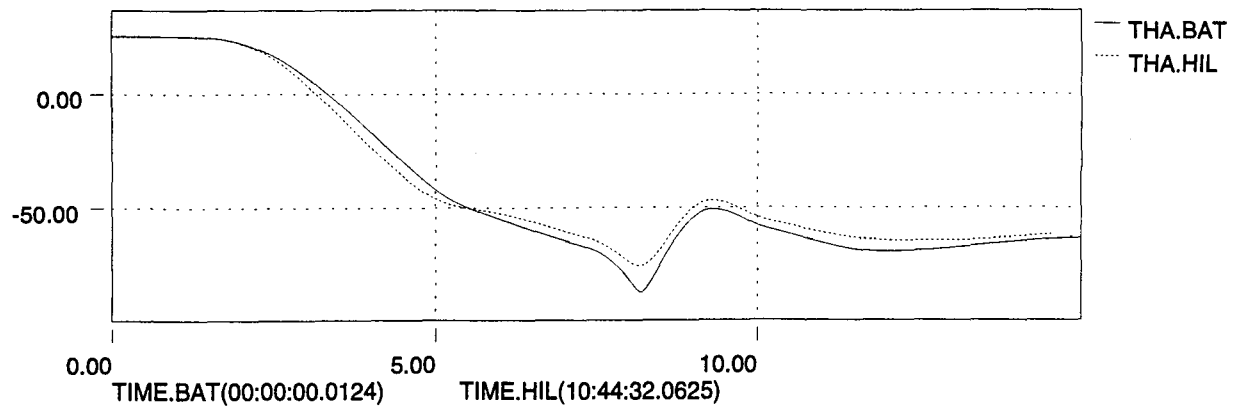
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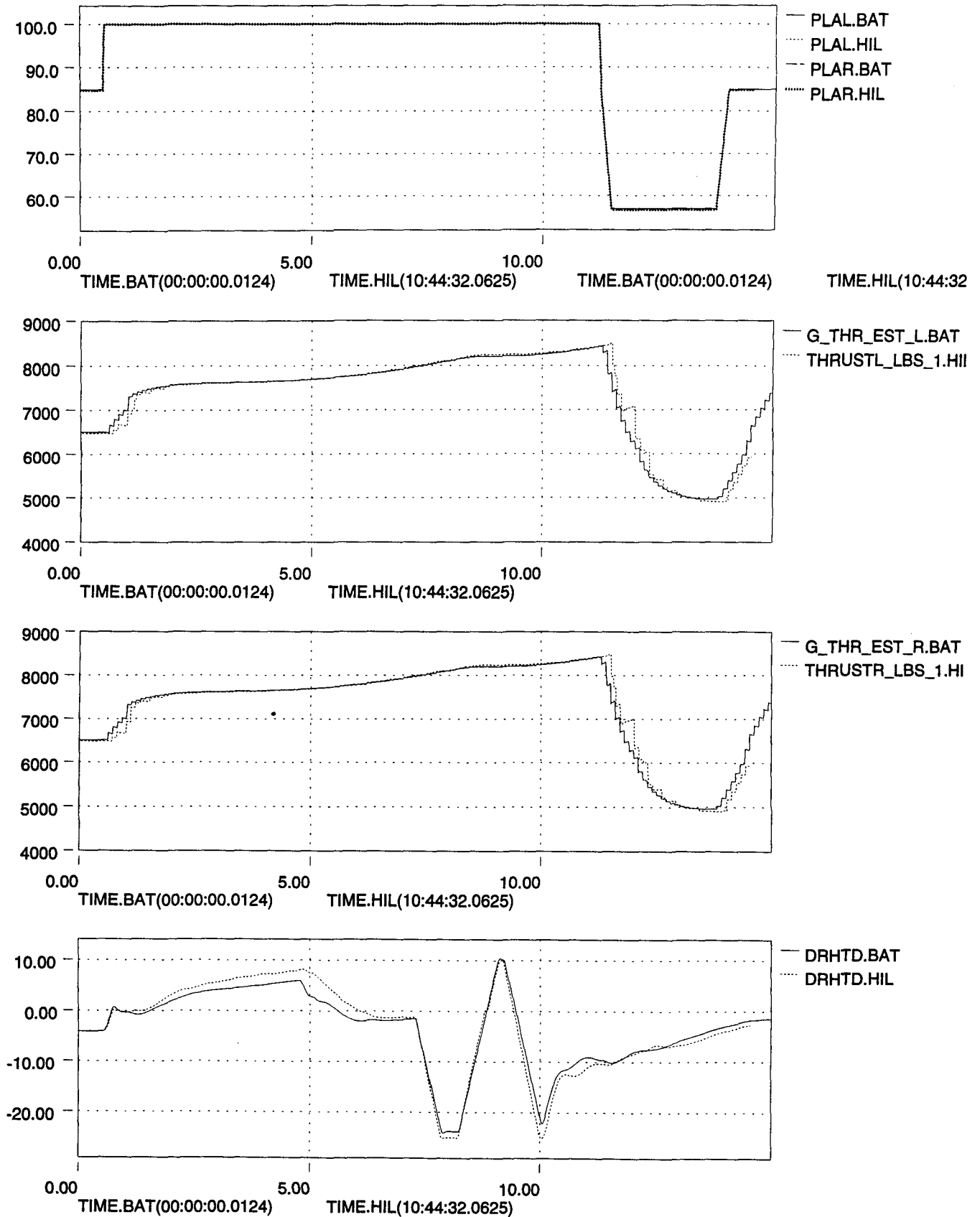
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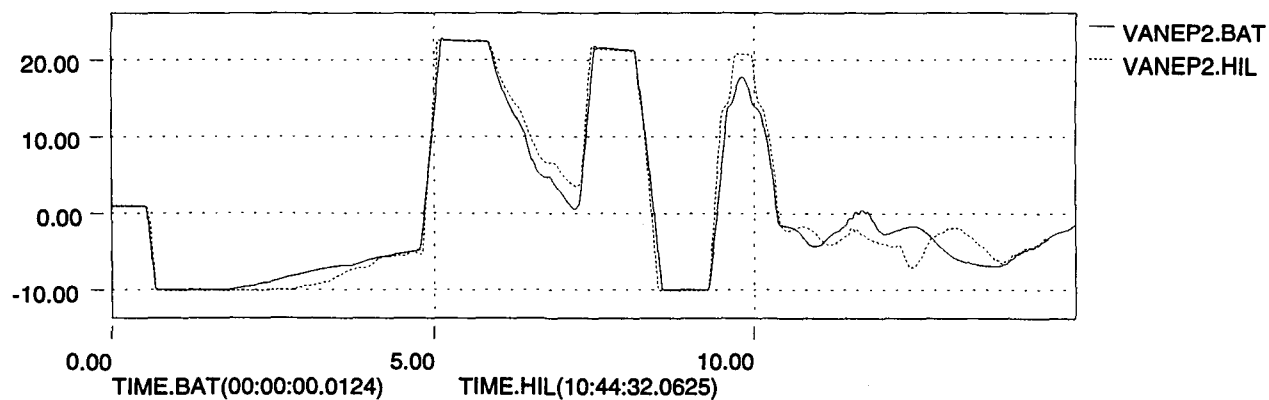
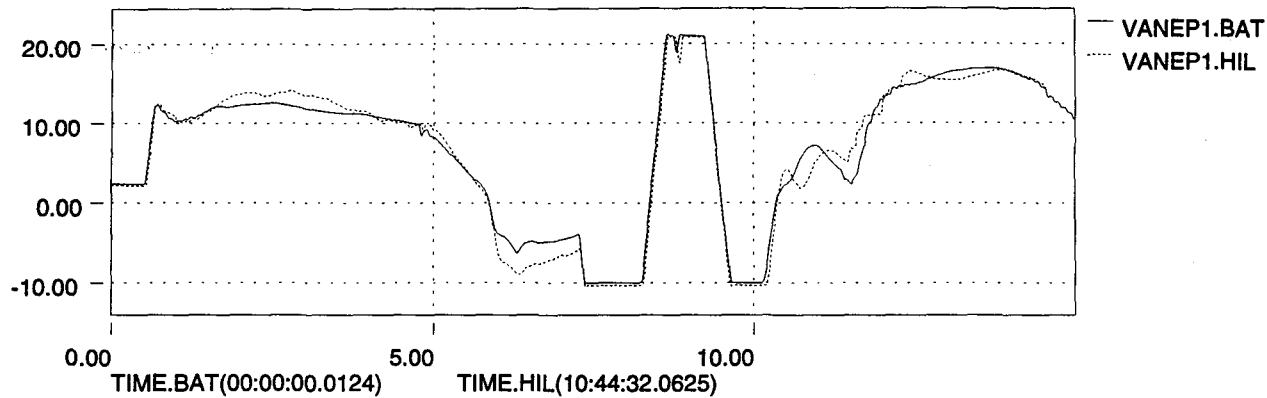
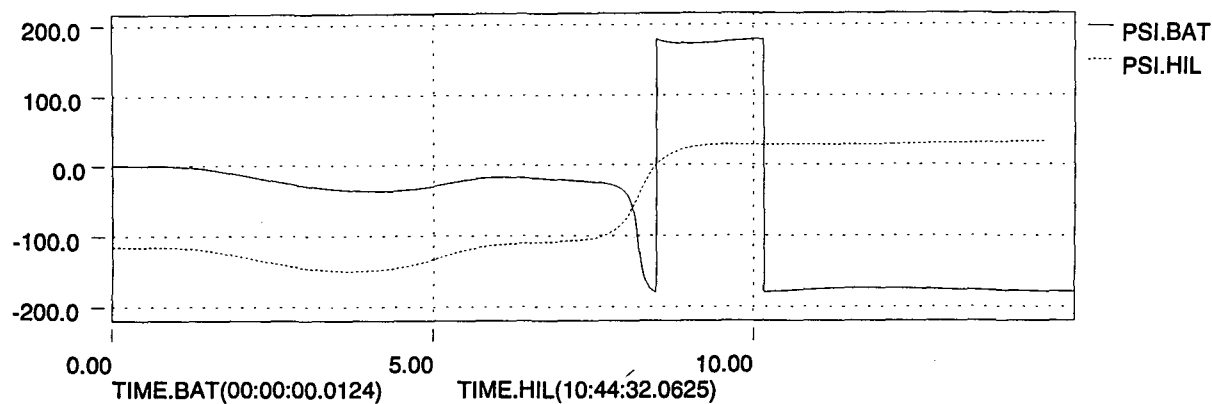
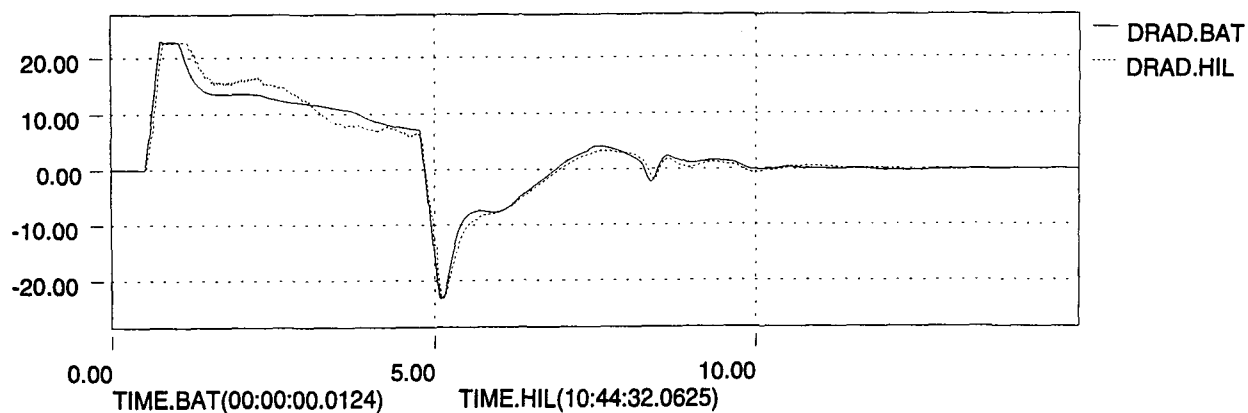
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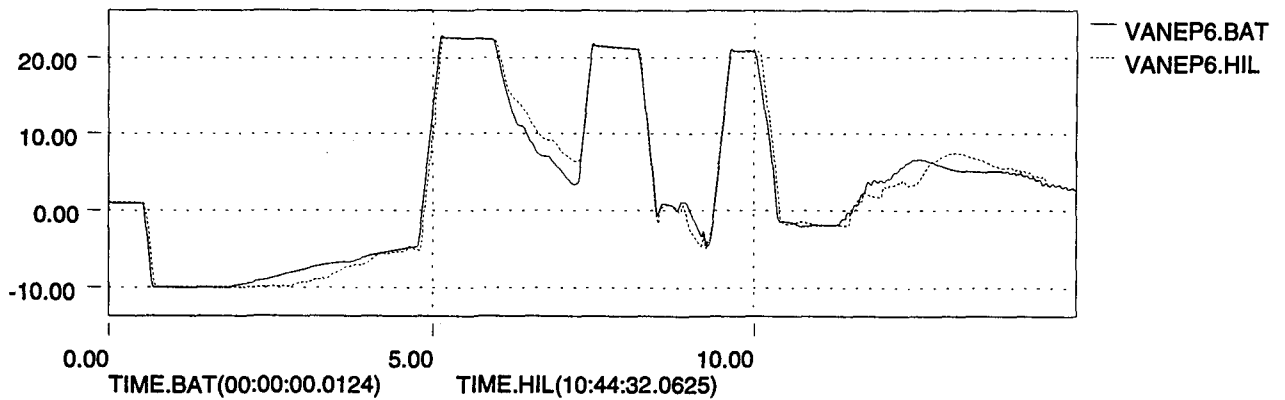
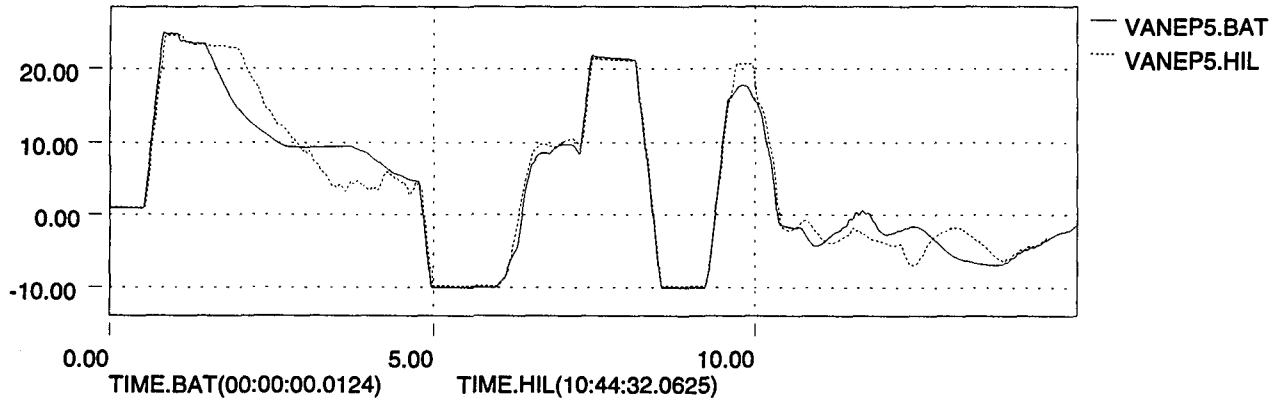
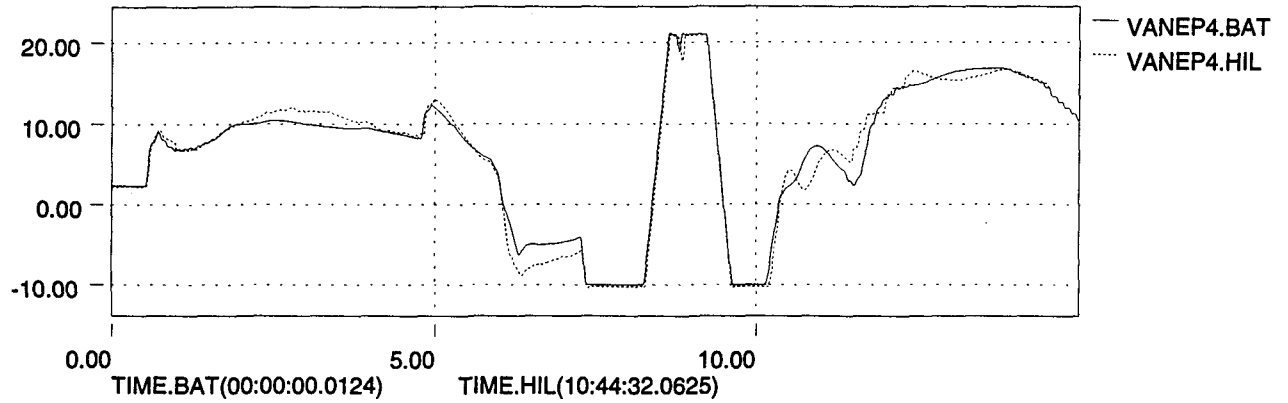
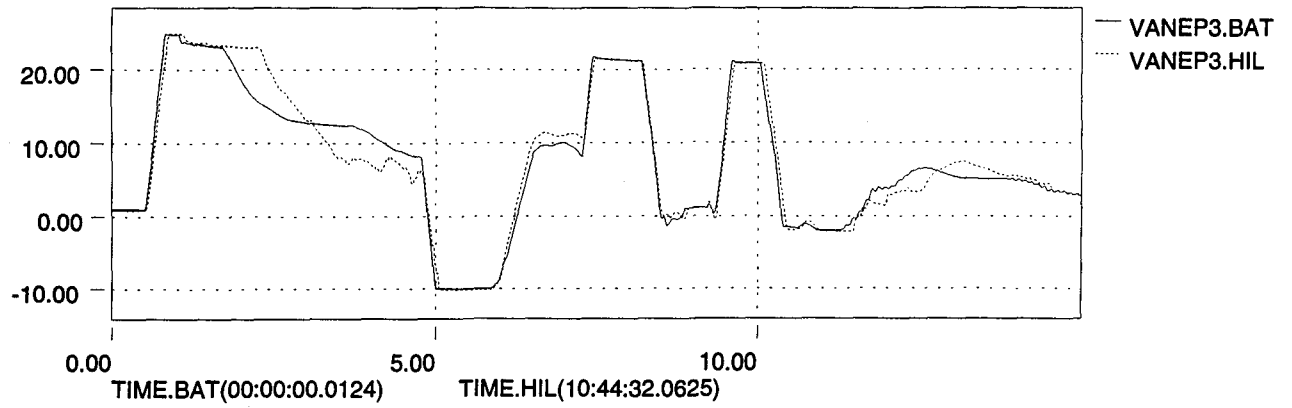
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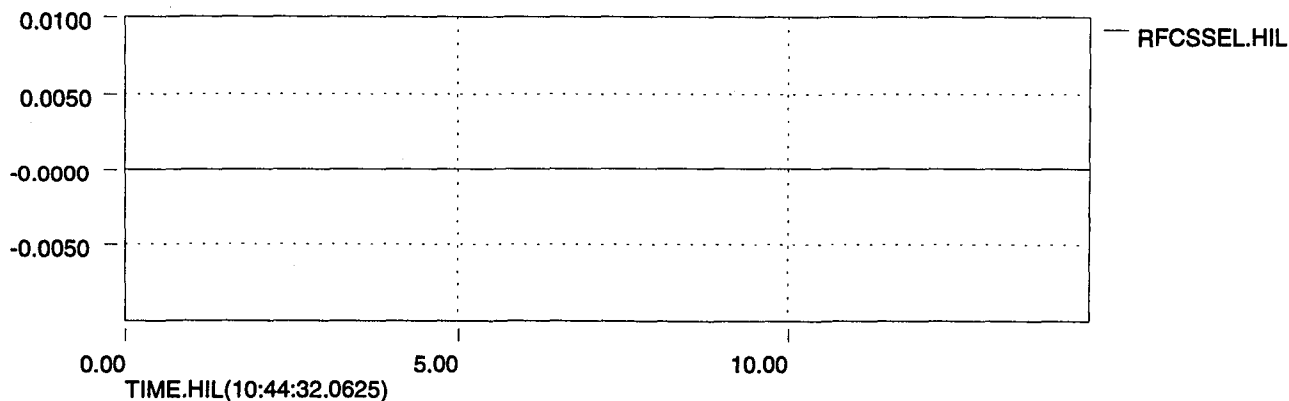
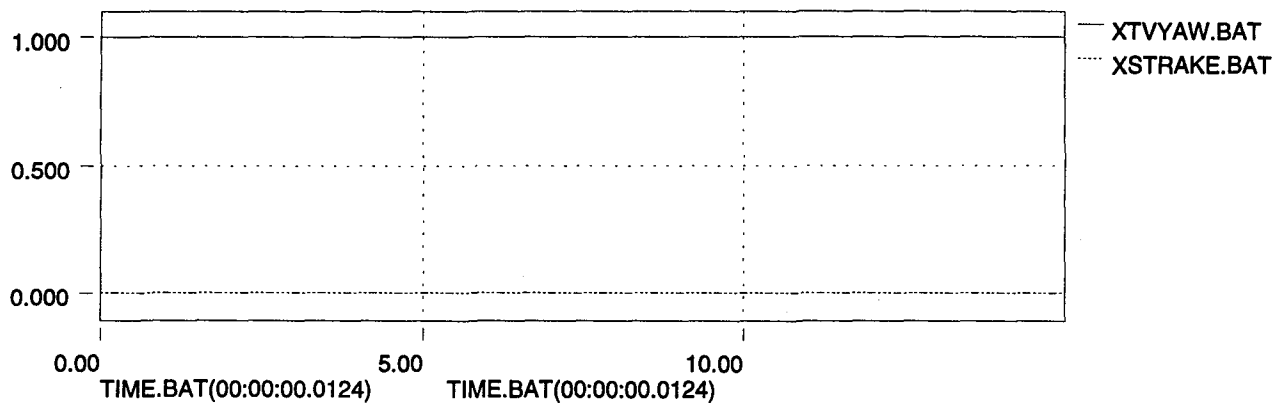
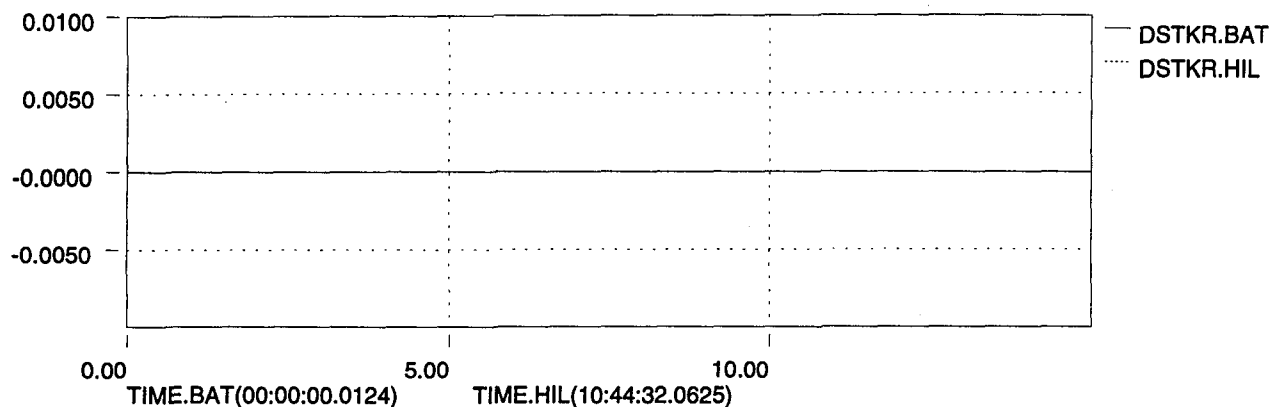
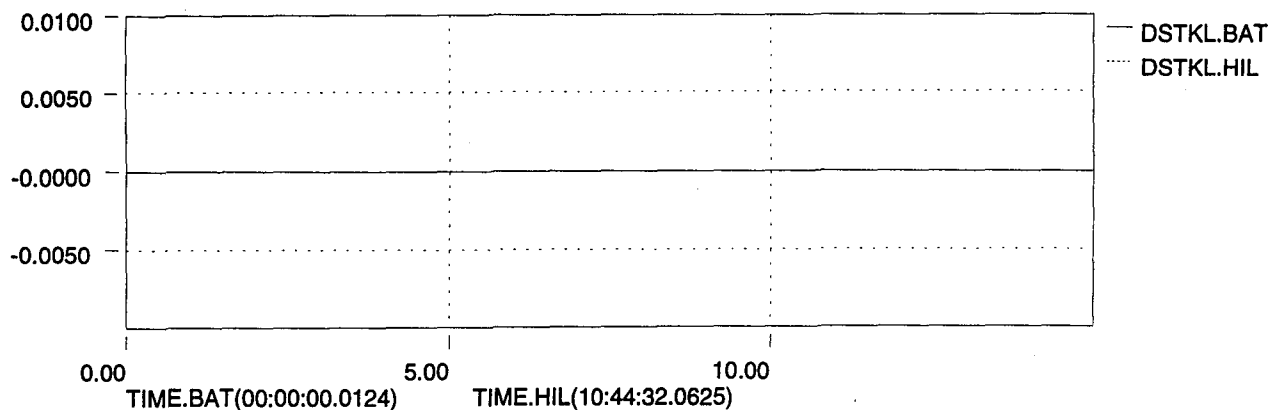
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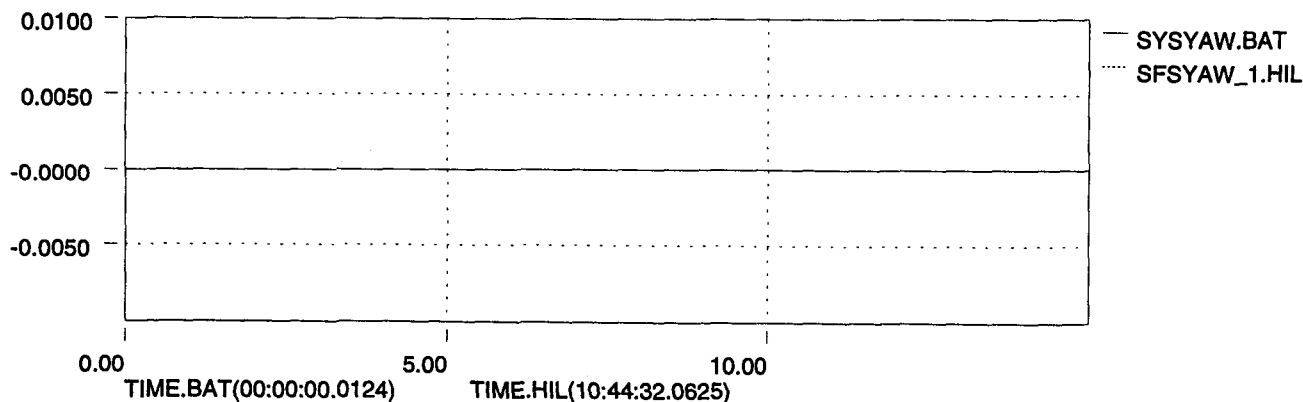
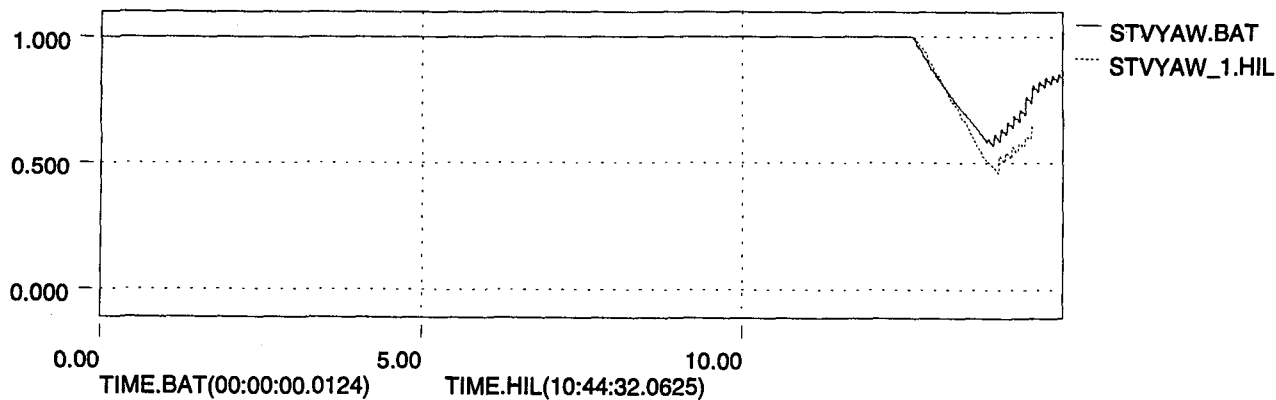
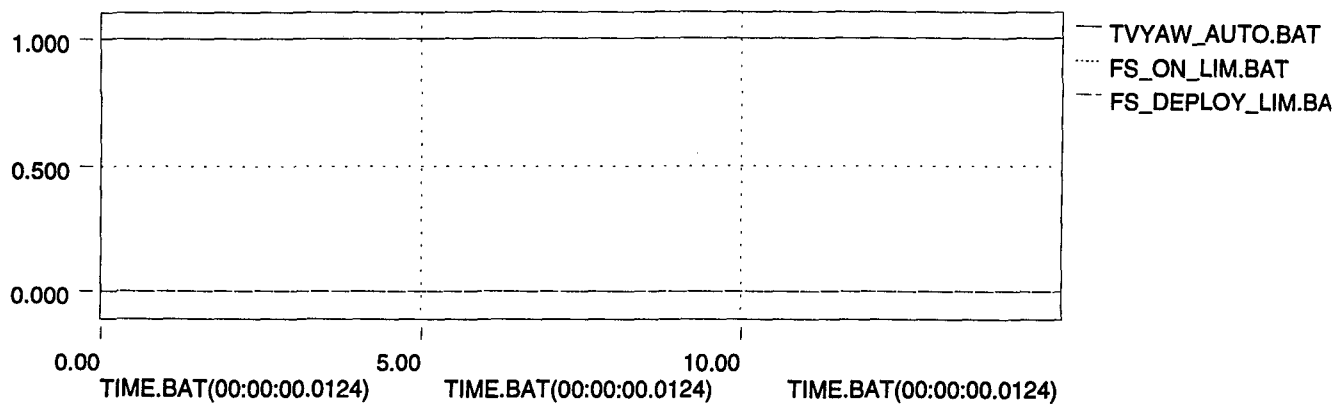
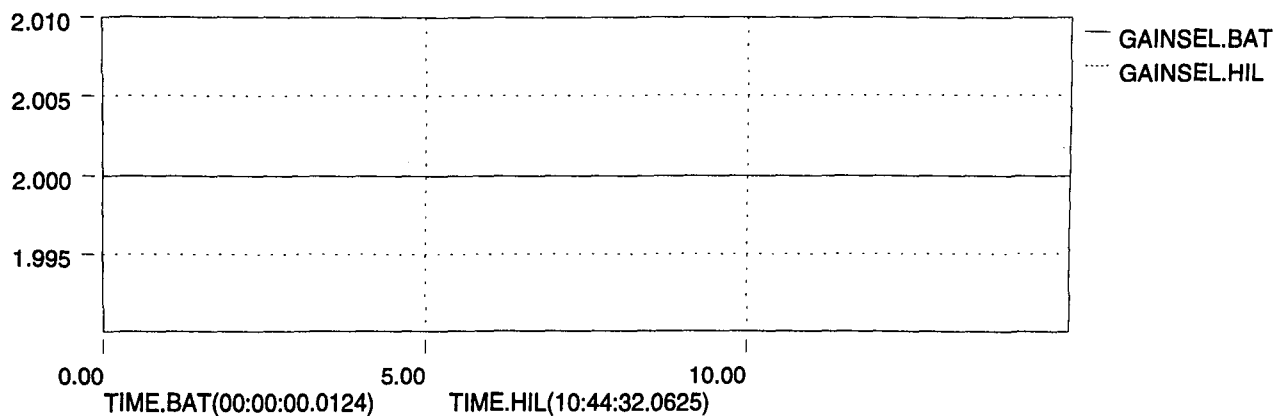
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13. ABSTRACT (Maximum 200 words) The ANSER Control Laws were implemented in Ada by NASA Dryden for flight test on the High Alpha Research Vehicle (HARV). The Ada implementation was tested in the Hardware-In-the-Loop (HIL) simulation, and results were compared to those obtained with the NASA Langley batch Fortran implementation of the control laws which are considered the "truth model." This report documents the performance validation test results between these implementations. This report contains the ANSER performance validation test plan, HIL vs. Batch time-history comparisons, simulation scripts used to generate checkcases, and detailed analysis of discrepancies discovered during testing.				
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